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BUREAU OF PLANT INDUSTRY

AGRICULTURAL EXPERIMENT STATIONS AND SEED FARMS

1. Central Experiment Station, Manila
2. Lamao Experiment Station, Limay, Bataan
3. Maligaya Rice Experiment Station, Muñoz, Nueva Ecija
4. Lipa Citrus Experiment Station, Lipa, Batangas
5. Gandara Seed Farm, Gandara, Samar
6. Baguio Experiment Station, Baguio
7. Ilagan Tobacco Experiment Station, Ilagan, Isabela
8. Maridagao Rubber Station, Pikit, Cotabato
9. Los Baños Economic Garden, Los Baños, Laguna
10. Guinobatan Abaca Experiment Station, Guinobatan, Albay
11. Mindanao Experiment Station, Aroman, Carmen, Cotabato
12. Granja Sugarcane Experiment Station, La Carlota, Occidental Negros (under lease)

SUBSTATIONS

1. Davao Seed Farm, Davao Penal Colony, Davao
2. Kidapawan Wrapper Tobacco Substation, Kidapawan, Cotabato
3. Halcon Rubber Substation, Baco, Mindoro (under lease)

RESERVATIONS

1. Gingoog Lanzon Reservation, Gingoog, Oriental Misamis
2. Abaca Disease Station, Kapatalan, Siniloan, Laguna
3. Quisolon Reservation, Bukidnon
4. Bansalan Reservation, Davao

TABLE OF CONTENTS

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TOBACCO IN THE PHILIPPINES [1]

BY DOMINGO B. PAGUIRIGAN and PRIMITIVO P. TUGADE
Of the Tobacco Research Section, Bureau of Plant Industry

FIFTY-THREE PLATES

PART I. INTRODUCTION

HISTORICAL BACKGROUND

For the proper appreciation of the development of the tobacco industry in the Philippines a résumé of its history is indispensable. This history may be divided into at least five eras, each èra characterized by important events.

Introduction of tobacco in the Philippines (latter part of the 16th century-1781).—The tobacco plant, being a native of the New World, was unknown in the Philippines until, according to Mosquera y Garcia (1880), the Spanish Missionaries brought seeds of the plant for the first time into the Islands during the latter part of the sixteenth century. These Missionaries were on their way to the Philippines by way of Mexico. This step was apparently inspired by a desire of the Spaniards to grow a profitable crop in the Islands in emulation of the New World Colonies.

From the beginning it was found that the plant was adapted to the climate and soil conditions of the Philippines. Notwithstanding this fact, however, the production of tobacco on a

[1] To be reprinted as Department Popular Bulletin No. 15.

commercial scale was rather slow in development. Perhaps the greatest factor that contributed finally to the ultimate development of the industry was the spontaneous adoption of the smoking habit by the Filipinos.

The Government monopoly (1781–1882).—In 1781 when the production was big enough, the Government began to think of monopolizing the profits derivable from the crop. It was during this year that the famous Government Tobacco Monopoly was founded by a decree of the then Captain-General Don José Vasco y Vargas, the specified object of which was to increase the revenue of the Islands. Under the monopoly, the production of tobacco as well as its manufacture was entirely under Government control. In the field there was a chief appraiser residing at the provincial capital, under whom worked a force of subordinates known as "alumnos aforadores." These "alumnos aforadores" were further aided administratively by the Municipal headman or "caudillo" who was at the same time "gobernadorcillo" (little governor) and his "tenientes" (lieutenants). So, on the whole, the tobacco monopoly was almost a perfect organization and can be likened to the present arrangement of the Philippine Government all the way from its central office in Manila to the last barrio organization unit.

According to Jagor (1875) among all Philippine industries tobacco was the chief source of revenue of the Colonial Government during the monopoly. This fact made the Government very strict in the administration of the monopoly and extreme penalties were meted out for the slightest violation of the regulations.

As estimated by an English Consul, during the fiscal year 1866–1867 the Government derived an income of nearly ₱8,500,000. During the same fiscal year the Government spent just over ₱4,500,000. Evidently this fiscal year was exceptional inasmuch as between the years 1865 and 1869 the total revenues derived from the monopoly averaged a little over ₱5,000,000 only every year. Until the abolition of the monopoly at the close of the year 1882, these revenues were steady. Aside from making the Philippine Government quite prosperous, the monopoly relieved Mexico from providing a regular subsidy for the maintenance of the Philippine Government.

At first the cultivation of tobacco was allowed only near Manila. Its extension to Northern Luzon led to the discovery that the best quality of tobacco could be produced particularly

in the Cagayan Valley. Foreman (1906) wrote that at the beginning the monopoly was enforced only in the provinces of Isabela, Cagayan, La Union, Abra, Ilocos Sur, Ilocos Norte, and Nueva Ecija. Although tobacco was cultivated in the Caraballo range, this was ignored, obviously because of difficulty in chasing the mountain tribes. The Igorots were finally allowed to plant tobacco in 1842.

It was only in 1840 that the Visayan Islands were also included under the monopoly when the production of tobacco became important there. Even in Tayabas, Marinduque, and Mindoro tobacco was being grown. For some reason, however, the production of tobacco in these three provinces did not last long. The regulations governing the traffic in Visayan tobacco were different from those in Luzon. In the Visayas, the growers were permitted to place their crop in the open market.

The main feature of the monopoly system in Luzon consisted in obliging or forcing every family to raise at least 4,000 plants per season and, in case of failure, the family was fined. The entire crop was delivered to the monopoly's warehouses and not a single leaf was left to the grower.

A Nueva Ecija landowner and tobacco grower wrote a letter which was published in the newspaper "El Liberal" in Madrid in the year 1880, in which he described the conditions of the operation of the monopoly in his province. Jagor (1875) quoted the letter as follows:

> The planter was only allowed to smoke tobacco of his crop inside the curing sheds which were usually erected on the fields under tilth. If he happened to be caught by a carabineer only a few steps outside the shed with a cigar in his mouth, he was fined ₱20. To a cigarette, 50 cents—and adding to these sums the cost of conviction, a cigar of his own came to cost him ₱7.37½ and a cigarette ₱1.87½. The fines in Nueva Ecija amounted to an annual average of ₱7,000 on a population of 170,000. From sunrise to sunset the native grower was subject to domiciliary search for concealed tobacco—his trunks, furniture, and every nook and corner of his dwelling were ransacked. He and all his family—wife and daughters—were personally examined; and often an irate husband, father or brother, goaded to indignation by the indecent humiliation of his kinswoman, would lay hands on his bowie-knife and bring matters to a bloody crisis with his wanton persecutors.

Classification of the leaves was strictly observed and all rejected leaves were burned. Only the unrejected leaves were paid for. The payment being made in treasury notes added to the sufferings of the growers. Their simple minds and need-

iness made them easy victims of speculators who bought the notes at great discounts.

Even the "cabezas de barangay" were threatened in case of failure of the growers to comply with the stiff regulations. Corporal punishments, imprisonment and immersions in water became so rampant that riots like those in the Ilocos region in 1807 and 1814 caused the death of many Spaniards.

The growers protested against their sad plight and during the incumbency of Captain-General Domingo Moriones (1887–1880) they were to have been given a hearing. But this was never realized owing to a financial crisis prevailing in Spain at the time.

Not only were the growers the victims of the disloyal officials but the Government as well when grafts also became rampant.

The present satisfactory system of weights and measures used in the tobacco industry was developed during the monopoly as follows:

1 fardo = 40 manos (hands)
1 mano = 10 manojitos (little hands)
1 manojito = 10 leaves
1 quintal (gross) = 50 kilograms

The "manojito" is now discarded so that a "mano" is equal to 100 leaves. Actually the "quintal" is equal to 46 kilograms net, but from the time of delivery until the leaves are thoroughly seasoned they lose four kilograms for every "quintal". Hence the equivalent of 50 kilograms for newly cured tobacco is fair.

Likewise the present Government official grades of leaf tobacco, enumerated hereunder, are a relic of the monopoly:

Classes		Length
First (primera)	=	42 centimeters and above
Second (segunda)	=	32–42 centimeters
Third (tercera)	=	23–32 centimeters
Fourth (cuarta)	=	16–23 centimeters

Leaves less than 16 centimeters long were rejected at first, but were later considered as fifths (quintas).

The tobacco factories during the monopoly were described by Mosquera y Garcia (1880) in the following manner:

"There were five factories which functioned regularly and at full blast since they were assigned monthly quotas fixed by the Centro de Colecciones y Labores (Collection and Labor Center) the immediate office in charge, which in turn is based upon the order of the Administración Central de Estancadas (Central Administration of the Monopoly).

The organization of these factories was more or less uniform. A factory was divided into wings, sections and tables. Each factory was under an inspector in charge of the economic and administrative functions, assisted by a bookkeeper and an additional adequate personnel of subordinates.

A census of the factories taken on December 6, 1872 showed that there were 15 wings of operators each or 7,400 tables employing a total number of operators of about 20,000."

It may be observed that the number of factory workers 60 years ago is virtually the same as that of the present, notwithstanding the increase in output. The only explanation for this is the fact that practically all labor then was human. That is, machinery was not as yet in use.

The following table, as borrowed from Jagor (1875), is reproduced here for the purpose of providing an idea of the shapes (menas) and prices of cigars prevailing during the monopoly:

TABLE 1.—*Classes and prices of cigars during the monopoly*

Classes (Menas)	Corresponding Havana brands	Price			Number of cigars in an arroba
		Per arroba 25 lbs.	Per 1,000	Per cigar	
		Pesos	*Pesos*	*Cents*	
Imperiales	The same	37.50	30.00	4	
Prima veguero	do	37.50	30.00	4	
Segunda veguero	Regalia		26.00		
Prima superior filipino	do		26.00		
Segunda superior filipino	None	38.00	19.00		
Tercera superior filipino	Londres		15.10		
Prima filipino	Superior Habano	21.00	15.00	2	1,400
	Segunda superior				
Segundo filipino	Habano	24.00	8.57$\frac{1}{8}$	1	2,800
Prima cortado	The same	21.00	15.00	2	1,400
Segunda cortado	do	24.00	8.57$\frac{1}{8}$	1	2,800
Mista	Segundo batido	20.50			
Prima batido, larga	None	18.75		1	1,800
Segundo batido, larga	do	18.75		$\frac{1}{2}$	3,750

Of the above, only the "Imperiales", "Regalia", and "Londres" have survived, although the first two have synonyms in "Solomones" and "Perfectos", respectively. And while there were 13 standard sizes then we have at present 15.

Jagor (1875) also wrote that the yearly production of leaf tobacco during the monopoly averaged 182,102 cwt. or 8,276,455 kilograms from the year 1860 to 1867. From Mosquera y Garcia (1880) we learn that in 1872 the price of one fardo primera (first), segunda (second), tercera (third), and cuarta (fourth), totalling 189.25 pounds or 86 kilos of leaf tobacco produced in

Cagayan was ₱19.25. The price therefore of one quintal or 50 kilos in 1872 was ₱11.30. The present quotations for Isabela and Cagayan 1938 crops assorted in the open market at Manila are ₱8.50–₱11 and ₱7.50–₱9.50 per quintal, respectively. Just why the price of leaf tobacco was dearer over fifty years ago is not easy to explain. These days, under normal conditions, the price of Isabela tobacco is ₱15 per quintal and during the post-war (World War I) years it reached ₱90.

Foreman (1906) and Jagor (1875) admitted that Manila cigars were second only to the best Havanas. Manila cigars were supreme throughout Eastern Asia and vied with Havanas in popularity in Europe.

Because the Government was apparently unable to stop the intolerable abuses and grafts prevailing, it finally abolished the monopoly exactly on the last day of the year 1882. With all its faults and evils, to the monopoly at least we owe the foundation of the present Philippine tobacco industry—one of the leading ones of the country.

Post-monopoly era (1883–1898).—In trying to dispose of its stocks as fast as it could, the Government could not help handling inferior products. The result was a crisis in the industry, the trade thus being adversely affected. As a matter of fact it took the Government over a year to liquidate its stocks and manufacture by private individuals or firms was done so hurriedly in an attempt to reap profits that the resulting products were of inferior quality. Lack of experience also contributed to the manufacture of inferior tobacco products.

The most notable event during this period occurred toward the end when the smaller factories were forced to close because of taxes, leaving in the field of business only the large factories with sufficient capital to buy large stocks of leaf tobacco. The ability of a factory to keep leaf tobacco for long periods is the key to success in the manufacture of quality cigars since only age can improve the taste of the leaf.

This period may be characterized by the following events:

(1) The growers became owners of their tobacco landholdings and with the end of Government interference peace reigned in the tobacco regions.

(2) The tobacco and tobacco products were taxed for the first time thus paving the way for a lucrative source of revenue for the Government.

(3) Individual initiative was developed. The Compañía General de Tabacos de Filipinas better known as the Tabacalera was founded. The same is still the leading firm in the Islands and is responsible for the tremendous trade between the Philippines and Spain, the balance of which is very much in favor of the Islands.

The status of the tobacco industry during this period may be gleaned from table 2, compiled by Foreman (1906).

TABLE 2.—*Shipment of cigars and leaf tobacco during the years 1882–1897*

Year	Cigars	Leaf	Year	Cigars	Leaf
	Thousands	*Tons*		*Thousands*	*Tons*
1880	82,783	8,657	1889	121,674	10,161
1881	89,502	7,027	1890	109,636	8,952
1882	103,597	6,195	1891	97,740	9,803
1883	190,079	7,267	1892	137,059	12,714
1884	125,091	7,181	1893	137,458	11,534
1885	114,821	6,799	1894	137,877	9,545
1886	102,717	6,039	1895	164,430	10,368
1887	99,562	4,841	1896	183,667	10,986
1888	109,109	10,229	1897	155,916	15,836

Comparing the above figures with those of 1938, it is noteworthy to observe that cigars exported in 1883 were only 10,000,000 less. The biggest leaf tobacco exportation which occurred in 1897 was, however, fifty per cent more than that in 1938.

Early American occupation (1898–1909).—It is necessary to separate this era because until the passage of the Payne-Aldrich Act, notwithstanding American occupation, the Philippines was foreign as far as trade was concerned. Furthermore, by virtue of the provisions of the Treaty of Paris, Spain continued to enjoy free trade with the Philippines. This period was therefore just a shadow of the preceding one. As may be noted in the following table, 3, while the exports of cigars were practically at a standstill those of leaf tobacco, however, nearly doubled compared with the average of the preceding 8 years.

TABLE 3.—*Philippine exports of cigars and leaf tobacco during the periods 1899–1903 and 1904–1908.*

Periods	Cigars	Leaf
	Thousands	*Tons*
1899–1903	168,805	18,579
1904–1908	107,935	22,730

Comparing the above figures with those of 1938, the export of leaf tobacco of this year was less than half that of the 1904–1908 average but the export of cigars was about 30,000,000 more than the average of 1899–1903.

The present era (1909–1939).—This era has been influenced very much by the Payne–Aldrich Act of 1909 as supplemented by the Underwood Tariff Act of 1913, World War I, the depression of 1930 and the Philippine Independence Act as amended by a measure (Public No. 300–76th Congress).

The Payne-Aldrich Act which provided for free although limited entry of Philippine tobacco products into the United States paved the way for the beginning of the present tremendous trade in Philippine tobacco products in the United States. The Underwood Tariff Act which finally established unlimited free trade between the United States and the Philippines was immaterial as far as the tobacco industry was concerned because the limitations imposed by the Payne-Aldrich Act were liberal enough. However, because of the opening of the great American market and the consequent danger of production of inferior cigars in the rush to take advantage of the free market, the Philippine Government decided to step in not so much to stimulate the tobacco export trade to the United States which is now the greatest market for Philippine cigars as to insure the shipment of only quality products. World War I boosted the Philippine tobacco industry tremendously during the post-war period beginning in 1923 when the belligerent nations were engaged in reconstruction. During this period the Philippines exported yearly ₱9,821,113; ₱14,799,395; and ₱337,000 worth of leaf tobacco, cigars and cigarettes, respectively. It is obvious that during the depression period the local consumption and export trade of tobacco products were adversely affected. Fortunately, however, the depression was not felt in the Philippines until 1930 and lasted until 1932 only. The Independence Law of 1935 which imposes a graduated tariff on the export crops of the country, including tobacco, beginning the fifth year (1940) of the transition period would have caused the death knell of the Philippine tobacco trade in the United States had not Congress enacted in 1939 a measure (Public No. 300–76th Congress) amending the Independence Law, providing among other things that, instead of a graduated tariff, tobacco products entering the United States shall be subject to quotas as follows:

Under the new measure the following so-called *original quotas* are established for shipments of these products to the United States for the calendar year 1940:

Cigars (exclusive of cigarettes, cheroots of all kinds, and paper cigars and cigarettes including wrappers)—200,000,000 cigars.

Scrap tobacco, and stemmed and unstemmed filler tobacco described in paragraph 602 of the Tariff Act of 1930—4,500,000 pounds.

For each calendar year thereafter through the calendar year 1945, each of the said quotas shall be the same as the corresponding quota for the immediately preceding calendar year, *less 5 per centum of the corresponding original quota.*

For the period January 1, 1946, through July 3, 1946, each of said quotas shall be one half of the corresponding quota specified for the calendar year 1945.

Part II. THE GROWING OF TOBACCO IN THE PHILIPPINES

EXISTING COMMERCIAL TYPES AND VARIETIES OF PHILIPPINE TOBACCO

In the cultures of the Estación Agronómica de la Isabela in 1891, Priego was able to distinguish the following five varieties: Pampano, Darulug, Vizcaya, Espada, and Romero. While the tobacco is not indigenous to the Philippines these varieties were considered native varieties because of their long adaptation under Philippine conditions. These five early existing varieties were grown solely for materials in cigar manufacture, which simply indicate that during the Spanish régime the only type of tobacco grown then was the cigar filler. Introductions of foreign varieties, however, have been made from time to time since the Spanish régime. Although not less than sixty foreign varieties have been introduced coming from ten different countries, only six have become of any commercial value.

Among the important introductions made are the following:

Table 4.—*List of foreign varieties of tobacco introduced by the Bureau of Agriculture (now the Bureau of Plant Industry), the year they were first tried, and the places of trial.*

Variety name	Origin	Year first tried	Place of trial
1. Sumatra		1903	Pampanga.
2. Vuelta Abajo	Cuba	1918	Isabela.
3. Havana	United States	1918	do.
4. Sumatra	do	1918	do.
5. Blumenstiel	do	1918	do.
6. Florida Sumatra	do	1920	Isabela and Cotabato.
7. Baker Sumatra	Sumatra	1920	Cotabato.
8. Havanensis	Cuba	1920	do.
9. Dumbara	Ceylon	1921	Isabela.
10. Olsen No. 1 (Turkish)	Turkey	1921	Cotabato.
11. Connecticut Havana	United States	1921	Isabela.
12. Connecticut Seedleaf	do	1921	Isabela and Cotabato.
13. Connecticut Broadleaf	do	1921	do.
14. Orinoco	do	1921	Isabela.
15. Connecticut Round Tip	do	1921	Cotabato.
16. "A" (P. I. No. 7836)	Unknown	1921	do.
17. "B" (P. I. No. 7836)	do	1921	do.
18. Batek	do	1921	do.

TABLE 4.—*List of foreign varieties of tobacco introduced by the Bureau of Agriculture (now the Bureau of Plant Industry), the year they were first tried, and the places of trial*—Continued.

Variety name	Origin	Year first tried	Place of trial
19. Bahia	Brazil	1923	Isabela.
20. S. P No. 1	Unknown	1924	Isabela and Cotabato.
21. S. P. No. 2	do	1924	do.
22. Baker's Sumatra	Sumatra	1925	Isabela.
23. Havanensis	Cuba	1926	do.
24. Dutch	United States	1927	do.
25. Spanish	do	1927	do.
26. Tall Zimmer	do	1927	do.
27. Kavalha	Turkey	1927	Isabela and Cotabato.
28. Manyleaf Soulouk	South Africa	1928	do.
29. Stewart Cuban	United States	1928	Isabela.
30. Hockanum Seedleaf	do	1928	do.
31. John William Seedleaf	do	1928	do.
32. Maryland Mammoth	do	1928	do.
33. Stand-up White Burley	do	1928	do.
34. Red Burley	do	1928	do.
35. Adcock	United States	1928	do.
36. Smetzger's White Burley	do	1928	do.
37. Virginia Bright	do	1928	do.
38. Goldleaf	do	1928	do.
39. N. C. B. Y.	United States	1928	do.
40. Longleaf Gooch	do	1928	do.
41. Connecticut Round Tip	do	1929	do.
42. Goundie	Germany	1929	do.
43. Fortheimer	do	1929	do.
44. Gaudertheimer	do	1929	do.
45. Friedrichsthaler	dc	1929	do.
46. Harinapali	British India	1929	do.
47. Mandhatta	do	1929	do.
48. Turkish	Turkey	1929	do.
49. Samsoun Bafra	do	1929	do.
50. J. Jelly White Burley	United States	1929	do.
51. Stand-up White Burley	United States	1929	Isabela.
52. Howells White Burley	do	1929	do.
53. Arkadia Tyck Kulok	Russia	1930	do.
54. Havana	do	1930	do.
55. Samsoun	do	1930	do.
56. Trebizond	do	1930	do.
57. Platana Arcadia	do	1930	do.
58. Diubec	do	1930	do.
59. Jamaica	United States	1933	Los Baños
60. Gold Dollar	do	1935	do.

The Bureau of Agriculture, now Bureau of Plant Industry, introduced 60 varieties from 1903 to 1935 as shown in table 4. There is in all a probable introduction by different institutions of around 80 varieties since 1900 up to the present time. Of this number only a few became of commercial value; the rest were

eliminated as they were found not adaptable to Philippine conditions. The successful introductions are the Philippine Sumatra, the Baker Sumatra from which the present Ilagan Sumatra was isolated, the North Carolina Bright Yellow, the Adcock, the White Stem Orinoco, the Conqueror, the Bunat, the Florida Sumatra, and the Samsoun Bafra. The first two were introduced from Java, all the rest with the exception of the Samsoun Bafra, from the United States. The Samsoun Bafra was introduced from Turkey.

Of these successful introductions, the Sumatra varieties (Baker Sumatra, Ilagan Sumatra, Florida Sumatra) belong to the wrapper type and all the rest are of the aromatic cigarette type. Tobacco varieties are generally grouped first into types based upon their primary utilization in the tobacco manufacturing industry. Standard varieties are varieties differing constantly in one or more characters from one another and having commercial value. As only one species of *Nicotiana,* namely, *tabacum,* is cultivated commercially in the Philippines, all types and varietal references in this paper are understood to be of this species only.

There are four distinct types of tobacco grown in the Philippines recognized in the market, namely, the cigar filler type, the wrapper type, the aromatic cigarette type, and the miscellaneous type.

1. *The cigar filler type.*—The cigar filler type forms the biggest bulk of our production amounting to almost 750,000 *quintals* annually. The important producing provinces named in the order of their importance are Isabela, Cagayan, La Union, Pangasinan, Cebu, Leyte, Ilocos Norte, Oriental Negros, Occidental Negros, Abra, Ilocos Sur, and Oriental Misamis. The important standard varieties under this type are the Simmaba, Vizcaya, Espada, Marogui, Repollo, and Pampano. These varieties are late maturing. They are commonly characterized by their very rank growth (tall to very tall), large to very large stalks and their numerous, large to very large, coarse-veined, sessile leaves which are either horizontal or drooping with reference to their position on the stalk. The different varieties are distinguishable from one another chiefly by the shapes and positions of the leaves. The Simmaba is easily recognized by having the broadest leaves which are almost erect in position.

The internodes are short. The Vizcaya has broadly elliptical horizontal leaves and longer internodes; the Marogui has partly erect, slightly undulating, light green ovate leaves; the Pampano has horizontal, undulating, broadly ovate dark green leaves; the Repollo, erect medium-broad elliptic leaves; and the Espada, very narrow or lanceolate leaves.

The best crop under this type comes from Isabela and Cagayan and is principally utilized to form the main bulk in the manufacture of the more expensive cigars. The production of the other provinces is used for the manufacture of the cheaper cigars and for the native-style cigarettes and smoking or pipe tobacco. Tobacco farmers in the different tobacco districts call these standard varieties by several names so that one is led to believe that there exist so many varieties under this type. Actual tests and investigations conducted by the authors show that most of the varieties grown by farmers and which are called by other names are simply synonymous with any of the herein named standard varieties. Tables 5 and 6 show the actual standard variety equivalent of the different varieties of tobacco grown by farmers in different districts.

TABLE 5.—*Tobacco varieties from other Philippine regions compared with Cagayan Valley standard varieties through actual tests at the Ilagan Tobacco Station.*

Variety	Regional source	Cagayan Valley standard variety equivalent
Cacites nga Lubag	Eastern Visayas	Romero.
Antolin	Northern Central Luzon Plain	do.
Pangasinan	do	Repollo
Kaviteño	do	Espada
Isabela	do	Repollo
Dinumero	do	Espada
Espada	do	do.
Batek	Ilocos provinces	Simmaba
Alicano	Western Visayas	Repollo
Barocana	do	do.
Siate	do	do.
Morada	Itawis District	Romero
Daraoisois	do	do.
Capigued	do	do.
Bacari	do	do.
Tettalay	do	do.
Iloilo	Western Visayas	Appears to be a different and therefore a new variety.

TABLE 6.—*Tobacco varieties from other Philippine regions compared with Cagayan Valley standard varieties through actual survey of the regions.*

Variety	Region where grown	Cagayan Valley standard variety equivalent
Pampano	Ilocos	Pampano.
Salopingpingan	do	do.
Bansuroy	do	Marogui.
Batek	do	Simmaba
Repollo	do	Repollo
Cagayan	do	Espada
Al-langigan	do	Espada
Renta-Pugot	do	Romero
Lapondan	Western Visayas	Vizcaya
Romero	Ilocos	Romero
Siate	Western Visayas	Repollo
Cacites	Eastern Visayas	Romero
Berlin	do	Vizcaya
Barili	do	do.
Simmaba	La Union	Simmaba
Limmogo	do	do.
Sulcok	Ilocos Sur	Marogui and Repollo
Allangigan	La Union	Marogui
Limmogo	La Union	Marogui
Daraoisois	Cagayan	Espada
San Juan	La Union	Vizcaya

2. *The wrapper type.*—The wrapper tobacco is the most expensive type of tobacco that can be grown by any grower. Under this type are two subtypes differing from one another by the cultural systems employed.

The first subtype is the sun-grown wrapper type. The varieties under this type are the Baker Sumatra, Ilagan Sumatra, Florida Sumatra and several promising hybrids. The important characteristics of these varieties are their erect growth, medium height, fairly large but thin, ovate or roundish, fine-veined, erect leaves and slender stalks. The Baker Sumatra has the same development as the genuine Sumatra with ovate erect leaves. It was introduced into the Philippines by the late Dean Charles Fuller Baker of the College of Agriculture of the University of the Philippines. The Ilagan Sumatra is a strain developed and segregated by intensive pure line selection and it differs from the Baker Sumatra by having bigger and rounder leaves. It was called Ilagan Sumatra in honor of its town of origin. The Florida Sumatra has the biggest leaves among the three named varieties but the veins are quite prominent though almost perpendicular to the midribs. The leaves are thicker than those of either the Baker or Ilagan Sumatra

and suckers are produced profusely. It was introduced from Florida, U. S. A.

The second subtype is the shade-grown wrapper type which is produced under artificial shade. The appropriate varieties for shade culture are the native Simmaba and the Vizcaya. The characteristics of these two varieties are already described under the cigar filler type. While these two varieties are strictly under the cigar filler type, yet when cultured under artificial shade they become excellent varieties for wrapper purposes. These two varieties constitute the greatest bulk of our present wrapper tobacco production. Our principal wrapper producing provinces at the present time are: Isabela and Cagayan for the sun-grown wrapper type, and La Union, Batangas, and Ilocos Sur for the shade-grown type. It has been observed that the most profitable method of producing wrapper of good quality is to resort to artificial shading which, although seemingly more laborious and expensive, yields bigger returns.

There are several promising hybrids which are in the process of purification but which can not be fully described in this paper as they are still under further study. Among these are the B_x and the G_x hybrids of Gutierrez which were first crossed in 1922 and 1929, respectively. B_x is a cross between the Baker Sumatra and the Florida Sumatra while the G_x is a cross between the native Vizcaya and the Baker Sumatra. The pioneer work on tobacco hybridization in the Philippines was that of Tirona, performed in 1914 at Los Baños, Laguna. From a cross between the Connecticut Broadleaf and Cagayan (probably the Marogui variety), Tirona produced a hybrid which bore his name and which became quite famous. For some reasons, however, nothing is now heard of this hybrid.

The production of wrapper leaf tobacco has become so specialized a phase of the tobacco industry of the world that it might well be considered a distinct industry by itself. In the past, cigars were wrapped with the same materials used for filler, but the advance of civilization and ensuing refinements in taste made people the world over more critical in their demand for new and better things. At present cigars wrapped with fine, delicate, and light wrappers are in demand. The result was that some countries began to specialize in the production of the desired product, and today the Sumatra, the Cuban Havana, the Porto Rican, the Connecticut, and the Georgia wrapper

tobacco are the standard cigar wrappers, produced through highly specialized methods of culture.

The famous Sumatra wrapper, a product of long and painstaking research in acclimatization, breeding, and intensive culture, is arbitrarily accepted as the standard by which all wrapper leaves are judged. The Cubans themselves, notwithstanding the universally high reputation of their "Havanas," admit the superiority of the Sumatra to their own wrappers. Also, in spite of the world-wide distinction given to the United States cigar wrapper, the American manufacturers prefer the Sumatra for wrapping their high-grade cigars.

Practically in every cigar tobacco country efforts have been made and are being extended towards improving wrapper tobacco and the method of its production, in order to meet the demand and the dictates of fashion among smokers.

Leaf materials for cigar manufacture.—In cigar manufacture three distinct tobacco products furnish the materials, namely, the filler, the binder, and the wrapper. The first and the last are specialized products, that is, each is grown especially for the purpose for which it is intended. Filler tobacco, as the word indicates, is raised to form the main body of the cigar. The leaves, therefore, must be of good and rich aroma and of agreeable flavor, and must burn freely and evenly. Binders are used to cover or bind the fillers preparatory to final wrapping. For this purpose usually discarded wrapper or finer filler leaves are used.

The wrapper material is grown especially for wrapping cigars. It must, therefore, be uniform in color and free from holes. It must be very elastic, so that it can be wrapped smoothly and tightly around the cigar. The color must be light, the shape of the leaves almost round, and large enough to yield an optimum number of wrappers per leaf or per weight. It should have the same aroma and flavor as the filler, or, if not fulfilling this requirement, should at least be neutral so that it will not in any way mar the desirable qualities of the filler. Although the wrapper constitutes but one fifteenth to one twentieth of the cigar, its influence upon the quality of the cigar is very great, apparently on account of its being plain to the view and of its possible effects upon the combustion process. Certain it is that flavor and aroma of a wrapper are always considered in blending tobacco for high-grade cigars. Obviously, therefore, the most important of the three materials is the wrapper. It

is the real seller of the cigar. Instinctively, the smoker is first attracted by the outward appearance of the cigar just as a prospective buyer of a piece of furniture is first attracted by a beautiful finish. In view of this fact and because of the manifold requirements of a standard wrapper, the industry is classified as a specialized phase of the great tobacco industry.

Science has been called in to aid this industry with remarkable results. Experiment stations wholly devoted to research work in tobacco, particularly in wrapper production, have been established. The tobacco experiment station in Medan, Sumatra, the famous island home of the world's best wrapper, is a very good example of the way science is aiding this great industry. The activities of this station are considered to surpass the activities of any similar station elsewhere.

Sources of wrapper.—There are three principal countries supplying the wrapper tobacco of the world, namely:

(1) *Sumatra.*—The tobacco trade has accepted the Sumatra wrapper as unquestionably the best and, therefore, the standard of excellence for cigar wrappers. The Sumatra wrapper is produced in the island bearing the same name, a Dutch possession in the East Indies. The United States alone imports about 5,000,000 pounds of Sumatra wrapper yearly. Germany, France, England, the Netherlands, and other European countries are heavy purchasers of Sumatra wrapper tobacco. The Sumatra wrapper is not imported directly from the island of Sumatra but through inscription in Amsterdam and Rotterdam, Holland. Because of the peculiarly adapted soil and the climate of the island, Sumatra tobacco is naturally of a wrapper nature, a character which has been further improved by breeding and selection and by scientific methods of culture. A factor which can not be overlooked is the plentifulness of coolie labor, enabling the Sumatra producers to have the work done entirely by hand. The abundance of land makes intensive agriculture unnecessary. It is claimed that in Sumatra a tobacco field is used only once in seven to twelve years. That is, after it has been cultivated for one season, it is allowed to become nature's garden and is not cleared or used again until seven to twelve years afterwards.

The Sumatra wrapper is an almost tasteless, neutral tobacco as to flavor and, therefore, has an affinity to all kinds of cigar filler. Its further favorable characteristics are its glossy appearance, its highly uniform color, and its remarkable elasticity and fineness. American manufacturers have persisted in the use

of Sumatra wrapper in spite of the exhorbitant duty paid for it upon entrance into the United States. The fact that Sumatra never produces filler tobacco and does not supply wrapper to any local factories, compels her to produce a quality of wrapper that is universally accepted by importing countries. The outcome is the creation of the famous Sumatra wrapper which has an affinity to practically all filler tobacco produced in the tobacco producing countries.

(2) *Cuba.*—"Havana" seems to be better known than the term "Cuban" as applied to all tobacco grown in the island of Cuba. Havana as a cigar tobacco, that is, including filler and binder, is considered the finest in the world. Strictly speaking, however, with respect to wrapper, it has not the reputation of the Sumatra. In former years, the Cuban wrapper was produced in the open, but because of the demand for a finer grade the use of the shelter tent was introduced. Today, the Cuban wrapper is produced almost entirely under shade. Partidos district is claimed to be the most naturally adapted region in Cuba for the production of wrapper. The importation by the United States of Cuban leaf tobacco amounts to about 16,000,000 pounds annually, a great portion of which must be wrapper tobacco.

(3) *United States.*—The Connecticut Valley and the districts of Florida and Georgia are the principal wrapper tobacco regions of the United States. The former raises from 70 to 80 per cent of all wrapper tobacco produced; Georgia and Florida furnish the rest. Practically all the wrapper tobacco produced in the United States is grown under partial shade. The open-grown Connecticut Broadleaf and the Havana Seedleaf are used mostly for binders while the shaded Cuban are grown for wrappers. The annual production of the United States is from 30,000,000 to 40,000,000 pounds. There was a time when the Sumatra was tried in Florida, but ultimately the growing of this variety was given up because of its inferior characteristics when grown in this State. The Florida-grown Sumatra, however, is now cultured in the open as sun-Sumatra strictly for filler purposes. The varieties at present grown under shade for wrappers in Florida are the Big Cuban, a cross between Sumatra and Cuban and the Connecticut Round Tip, a Connecticut Broadleaf and Sumatra hybrid.

Miscellaneous sources of wrapper.—Porto Rico has become quite an important producer lately owing to the introduction of modern methods of culture, specially the use of shelter tents.

The United States imports from Porto Rico about 30,000 bales of leaf tobacco annually and no doubt a portion of this is wrapper tobacco. In tropical and semitropical countries like Mexico, and the Philippines, an appreciable amount of wrapper is obtained from the lower leaves which are thin and glossy due to the shade produced by the upper leaves. The supply, however, does not meet the demands of the manufacturers with the result that additional wrapper must be imported from the outside, mainly from the United States and Sumatra through Holland.

The United States does not import leaf tobacco for wrapper from the Philippines, but in her importation of cigars and cheroots the products of the Philippines form a large proportion. Philippine cigars, excepting a very limited proportion, are wrapped with native wrappers. High-quality Philippine cigars are either wrapped with imported Sumatra or with United States wrapper. Recently, however, the Filipino tobacco growers embarked into the production of purely wrapper tobacco by the use of shade, and in the course of a few years, the country may not only become self-sufficient in her wrapper needs, but may eventually become a wrapper-tobacco exporting country. The existence of ideal soil and climatic conditions coupled with the availability of suitable varieties for the production of wrapper tobacco in open culture, under more or less humid conditions and in shade culture under more or less droughty conditions, promise a future with bright prospects for the Philippines.

3. *The aromatic cigarette type.*—All the Virginia groups including the Turkish varieties are under this type. The important varieties are the Adcock, North Carolina Bright Yellow, White Stem Orinoco, Warne, Big Warne, White Burley, and the Samsoun Bafra. The first six varieties are of American origin; the last was introduced direct from Turkey through the efforts and courtesy of the American Consul at Constantinople in 1928. The American varieties are all medium in height and develop with more or less short internodes. With the exception of the White Burley which is so easily recognized by its dwarfed growth, white veins, chlorotic leaves and brown color when cured, all the rest of the American varieties cure yellow with the characteristic sweet aroma which is very dominant. The Adcock has the longest and broadest leaves, while the Orinoco is easily recognized by its characteristic lanceolate, narrow, erect leaves. The Warne is the tallest of the American varieties and the North Carolina Bright Yellow has the roundest leaves, with a breadth

index of over 50 per cent. The Big Warne has distinctly ovate leaves just as the Warne. The Samsoun Bafra, the lone Turkish variety adapted to Philippine conditions is the easiest to distinguish because of its small petiolate, ovate and erect leaves.

This type of tobacco is either sun-cured or flue-cured. The use of flue is by far the surest guarantee to obtain a real yellow crop which is the index of quality.

The principal problem confronting the growers of this type of tobacco is the preservation of the yellow color; it appears that this problem is hitched to the method of packing. Another problem in connection with this type of tobacco is that it is easily attacked by mold. This is of course to be expected because of the presence of the aroma or sweet taste which indicates that sugar is present. These problems, however, are not hard to solve and according to partial results so far obtained same can be avoided by packing the tobacco as soon as cured in air-tight containers.

4. *The miscellaneous type.*—The Batek, Sulcok, Morado, and Catabacuan are in a strict sense chewing tobaccos. With the exception of the Catabacuan which is produced from the only petiolate native variety, Romero, which is very aromatic but cures dark, the Batek, Sulcok and Morado can be produced from any of the standard cigar filler varieties. This type of tobacco is strong, thick and leathery because of early topping and overmaturity of the leaves before they are harvested. When the leaf produces prominent brown spots it is called batek; if it does not produce spots but simply cures brown or dark red it is called sulcok. If it cures yellowish without spot it is called morado.

CLIMATIC AND SOIL REQUIREMENTS

Climatic requirements.—The growing of tobacco is highly localized. The characteristics which distinguish one type of tobacco from another are primarily the results of a combination of climatic and soil conditions, together with the method of curing and the variety grown in this or in that locality. The various kinds of tobacco demanded by consumers also have a very great effect upon the production of specialized products. These demands are sucessfully met by the selection of the right locality and the use of persistently progressive methods. Tobacco is one of the most profitable cash crops; for this reason practically every agricultural country has tried to raise it. But while everyone has been and is still trying to employ the same

cultural and curing methods and using possibly the same seed or variety, yet the final product is, in general, only typical of this or that locality where it is produced.

The existence of different climatic and soil types in the Philippines, however, makes it possible for the country to produce all the principal types of tobacco demanded by the market. Southern Mindanao, as Cotabato and Davao, with an equal distribution of rainfall, is an ideal region, for the growing of open-grown wrapper. The interior valleys of the Ilocos region, particularly in La Union, grow fine wrapper under shade culture. By far, the Cagayan Valley produces the best cigar filler tobacco constituting the greatest bulk of our tobacco of commerce. The climate of the Cagayan Valley is characterized by a short dry period lasting only from one to three months. The Ilocos provinces, including Pangasinan, and the provinces of Leyte, Samar, Iloilo, Cebu, and Occidental and Oriental Negros also produce cigar filler tobacco but of a quality inferior to that of the Cagayan Valley. The aromatic cigarette types or the Virginia varieties which are principally used in the manufacture of American-style cigarettes are best adapted in Central Luzon where there is a distinct dry and wet season.

After a long range of observation and research it can now be concluded that tobacco growing in the Philippines can be delimited in the following regions:

1. Wrapper tobacco, open-culture can be undertaken in places with an almost equal distribution of rainfall as in Cotabato, Davao, certain districts of southern Laguna and the Bicol region.

2. The growing of shade-grown wrapper leaf tobacco can be undertaken in places with distinct dry and wet season if shading materials and cheap labor are available as in La Union and Ilocos Sur.

3. Cigar filler tobacco is best grown in regions with short dry season as in the Cagayan Valley.

4. The aromatic cigarette type or the Virginia group including the Turkish varieties are best adapted in places with distinct dry and wet season as in the provinces of Central Luzon.

5. The miscellaneous types are suitable to grow only in specific localities and, therefore, their production in more extensive and wider regions outside the present localities producing them is problematical. For instance, southern La Union and northern Pangasinan are the only districts producing the Batek tobacco of commerce. The towns of Sinait and Cabugao, Ilocos

Sur are the only districts producing the Sulcok, while the Itawis district of Cagayan Province is the only region producing the Catabacuan. It appears rather apparent that specific soil and climatic requirements are limiting the production of these kinds of tobacco to specific places and climates.

Soil requirement.—No crop is more responsive to slight changes in soil than tobacco. In the Philippines as elsewhere, there are only few localities where more than one kind of tobacco are grown. Even in these localities the resultant crop is generally used for the manufacture of only one kind of tobacco product. A good example is the Cagayan Valley where filler, binder, and wrapper types are produced, but these products are utilized only for the manufacture of cigars. Different varieties have been bred to meet specific requirements, but when these are transferred to a new environment, they immediately lose some of their characteristics, and consequently, some of their value. The ideal soil for tobacco is the sandy loam type which should be rich, deep, porous, well drained, and easily worked. Heavy soils, specially clay soils, are not suitable for tobacco with the exception possibly of the chewing type as they are likely to produce coarse and heavy crops. A good supply of organic matter must always be present in tobacco soils. Organic matter contains all the necessary plant foods in different stages of availability from the freshly turned over dead vegetative matter to the completely decayed and dissolved complex humic food.

The wrapper type requires exceedingly rich land in order to insure the rapid and uninterrupted growth of the plants and thereby prevent unnecessary thickening of the tissues, since the most desired characteristic of cigar wrapper leaves is their fine texture almost akin to silkiness. It is for this reason that wrapper tobacco should only be grown if not on virgin lands at least on old lands which are regularly renewed, as otherwise the heavy application of natural and commercial fertilizers will have to be resorted to. The wrapper districts of La Union are confined in the interior valleys where the soil is annually renewed by the washed deposits from the hills. In Laguna and Batangas where the soil is poor because the lands are old, the application of commercial fertilizer is always resorted to. Owing to the abundance of land, the wrapper tobacco growers of Sumatra can afford to fallow the same tract of land at wide intervals of time. This practice allows the ground to become

virgin once more before it is again used for growing wrapper tobacco.

The cigar filler type is less exacting than the wrapper type as to fertility requirement of the soil where it is grown. With the exception possibly of the Cagayan Valley where rich tobacco lands are abundant the other cigar filler districts are rather of average fertility. Tobacco lands in the Cagayan Valley, however, are naturally rich because of the yearly inundation of the Cagayan River, and it is on these flooded areas where the best cigar filler tobacco are produced annually. This favorable factor rather compensates for the little care given to the tobacco plantations by the growers. The Cagayan Valley crop is always considered the best cigar filler crop of the country as it is not too strong or gummy. All cigars for exports are made from this crop. Cigar filler crops produced in the Ilocos region, Pangasinan, and those from Leyte, Cebu, Iloilo, and Samar are used more for the manufacture of native-style cigarettes or for blending purposes in the manufacture of cigars for domestic consumption.

The aromatic cigarette type thrives best on soil of average fertility. The Turkish variety, however, gives better-quality crop on poorer soil but the yield becomes so low as to make it unattractive to grow this variety on poor soil. The difficulty encountered in growing this type of tobacco on rich land is that, while rank growth is easily attained, the desirable yellow color and the sweet aroma can not be obtained. When grown on poorer soils these qualities are easily obtained. This is mostly the case when curing is accomplished only by the sun-drying method.

The miscellaneous type is grown on heavier soils that are naturally fertile to insure vigorous and uninterrupted growth although in La Union and Pangasinan it is often grown side by side with the cigar filler tobacco. Poor soil never produces good Batek, Sulcok or Catabacuan unless it is heavily fertilized with either animal manure, guano or some commercial fertilizer.

Fertilizer.—With only a few exceptions, the application of fertilizers to tobacco is not generally practiced in the Philippines. This is because the best tobacco areas are inundated yearly thereby solving the problem of soil exhaustion. In the United States, however, no crop is so heavily fertilized as tobacco. Fertilization is followed by cover cropping and green manuring.

This practice prevails especially in the Connecticut Valley because it is believed there that the application of commercial fertilizer leaves a great deal of residue which will be leached out during the fall rains. The cover crop serves to catch the nitrification products from these residues. The cover crop is later on plowed under as green manure. Cowpeas, soybeans, vetch, rye, timothy, and other cover crops were found to be among the best green manures for tobacco fields.

The question of fertilizer application is not an easy one to solve. Cases have been known where, by chemical analysis of the soil, the necessary plant foods have been found abundant enough and yet the land has not produced a decent crop. The importance of the desired physical condition of the soil enters into consideration here. Fertilizers only give results when the soil is of the proper texture and contains sufficient moisture to render the plant food available to the plants. To obtain these conditions the soil grains must be thoroughly mixed; hence the value of thorough cultivation. The question of whether complete fertilizers, or simply the elements apparently lacking, need be applied is for the growers to decide. Owing to the high cost of fertilizers, there is a tendency on the part of the growers to use simple fertilizers. The determination of the deficient plant food then becomes necessary. The deficiency can be determined by classifying the land as to origin and farming adaptation, analyzing it chemically by groups, and testing it by actual field experiment.

The purpose of fertilizer application is to produce a rich land, not rich spot, so that the proper method of applying fertilizer is to broadcast and harrow it in. It can, however, be applied in the rows and covered during transplanting. The application of coarse manure in the fall or winter, followed either by late fall or early spring plowing, is recommended by the Wisconsin Experiment Station. Commercial fertilizers should be applied in the spring after the land has been plowed and shortly before transplanting. Fertilizers should not be applied unless the land is in good tilth, as otherwise the plants will not be in the best environment to use them. Furthermore, fertilizers, when applied on soil of poor tilth, are readily leached out.

As a general guide in the application of commercial fertilizers for tobacco lands the following are recommended:

1. Ammonia, 4 to 5 per cent; phosphoric acid, 2 to 4 per cent; potash, 8 to 9 per cent.

2. Ammonia, 2 to 4 per cent; phosphoric acid, 8 to 10 per cent; potash, 2 to 7 per cent.

TABLE 7.—*Most common sources of the three basic elements, their average composition and value which may be used for tobacco*

Fertilizer	Nitrogen	Phosphoric acid	Potash	Average application per acre	Average value per ton
SUPPLYING NITROGEN	*Per cent*	*Per cent*	*Per cent*	*Pounds*	
Nitrate of soda	16	0	0	200	$60.00
Sulphate of ammonia	20	0	0	175	75.00
Tankage (meat and bone)	5	11	0	400	31.00
Dried blood	12	4	0	300	60.00
Cottonseed meal	7	2	2	500	32.00
Fish	6	8	0	400	35.00
SUPPLYING PHOSPHORIC ACID					
Acid phosphate	0	15	0	600	16.00
Ground bone	3	24	0	300	35.00
Dissolved bone	2	16	0	500	25.00
SUPPLYING POTASH					
Sulphate of potash	0	0	50	200	55.00
Sulphate of potash and magnesia	0	0	28	400	30.00
				Tons	
Wood ash (unleached)	0	0	6	1	8.00
ANIMAL MANURES					
Barnyard manure	0.5	0.25	0.5	10	2.00
Sheep manure	1.0	0.5	0.5	6	3.00
Chicken manure	1.5	1.0	0.75	4	5.00

Tobacco farmers should avoid the application of fertilizers with appreciable amounts of chlorine and sulphuric and other free acids, as these elements markedly affect the burning quality of the leaf. Chlorine is contained in common salt, muriate of potash, kainit, and generally in the lower and cheaper forms of potash salts. The use of these fertilizers should, therefore, be avoided. Manures must not be allowed to lie long in the open because nitrogen in the form of ammonia escapes into the air while soluble plant foods such as potash and ammonia are washed out by rain. These materials should, therefore, be kept and seasoned out before they are applied in the fields.

Farmers always refer their fertilizer problems to the nearest experiment station to avoid grave mistakes and possibly useless expenditures. The planter must experiment with fertilizers himself.

A mixed fertilizer analyzing 12% nitrogen, 5% phosphoric acid, and 18% potash; and fertilika which contains 10% nitro-

gen, 10% phosphoric acid, and 24% potash were found to give very good results in old lands in Batangas, Laguna and Isabela provinces, respectively, when applied at 250 kilos per hectare.

SEEDBED AND FIELD OPERATIONS

Preparation of seedbeds.—The successful growing of any type of tobacco depends in a large measure upon the farmer's ability to rear vigorous, uniform, and healthy seedlings. Any land that is good for growing tobacco may be utilized for seedbed purposes. It is the general practice, however, to use higher ground for seedbeds to avoid the possible danger of floods and stagnant water. Sloping virgin lands, if available, are the best for seedbeds as the difficulties of laying deep drainage canals and the application of fertilizers are thereby avoided. In the tropics, the beds are prepared one meter by ten meters. This is a convenient size for the many operations involved—constructing, weeding, placing covers, watering, etc. The earth is raised about a foot above the general level in bed form and the sides of the beds are supported by bamboo which may be substituted by wood.

A path about one half of a meter wide, which serves also as drainage, separates the plots. Each bed is thoroughly worked to a depth of more than one foot. All roots, stumps, and other waste materials are raked out and the soil is thoroughly pulverized. This done, the beds are sterilized. There are various methods of seedbed sterilization, namely:

(1) *Open fire.*—In the tropics, where dead vegetation is abundant, the seed plots are covered with dry grasses, twigs, and bushes and are then burned. The heat is forced through the beds, killing suckers, roots, and seeds of weeds and fungus and bacterial organisms.

(2) *Roasting.*—Heating or roasting the soil in a suitable pan is a modification of the open-fire method. The soil of the beds is shoveled into pans and heated to a certain degree in order to kill all fungi and bacterial organisms. Then it is returned to the beds.

(3) *Hot water treatment.*—The beds are treated with boiling water to kill all weed seeds, roots, suckers, fungi, and bacterial organisms.

(4) *Formaldehyde treatment.*—A solution of formaldehyde (one part formalin to 100 parts water) is sprinkled on the beds at a ratio of one gallon per square foot. The beds are then

covered with burlap or sash to hold in the fumes. After a week they are ready for sowing. The common objection to this method is the costliness of the formalin.

(5) *Steam sterilization.*—Steam current from a boiler is passed through the soil several times. This method was devised by the U. S. Department of Agriculture, Bureau of Plant Industry and is now being extensively used in the Connecticut Valley. The outfit necessary for the operation consists of a boiler, some lengths of good pressure hose, and two or more pans made of galvanized iron or wood.

The use of any one of these methods depends upon its suitability to the place. In the Philippines, for instance, tobacco farmers do not sterilize their seedbeds but simply select virgin places for them.

The importance of the use of fertilizers on old land for seedbeds is best summed up by Olson in Bulletin 130 of the Pennsylvania Agricultural Experiment Station as follows:

"Tobacco plants are forced to spread their roots widely when growing in an insufficiently fertilized bed. This causes slow growth above the ground, and when the plants are pulled the straggling spreading roots are damaged, a condition which later interferes with the growth in the field. It is, therefore, advisable to fertilize the beds well for the reason that the plants will not only grow faster but the roots will not spread out in search of food; they obtain it in a small area, and consequently grow in a close, compact branch which makes it possible to pull the plants with small loss and less injury to the rootlets."

The application of fertilizer, however, requires discretion. While mineral fertilizers can and should be applied after sterilization, compost and animal manure should be applied before sterilization as these fertilizer materials may likely contain destructive organisms that will damage the seedlings. In the U. S. Department of Agriculture Farmers' Bulletin 571, Dr. Garner suggests the following method of fertilizing tobacco seedbeds:

"In the fall 40 pounds of lime and 200 pounds of stable manure to 100 square feet of seedbed are plowed under. In the spring about two weeks before sowing the seeds, additional fertilizer should be applied per 100 square feet of bed area consisting of 20 pounds of cottonseed meal or castor pomace, 1 pound of acid phosphate, and one half pound of carbonate or sulphate of potash. These materials are thoroughly spaded into the soil

to a depth of 4 to 5 inches and the surface of the beds brought to a fine tilth."

In the Philippines, more specifically in La Union Province, powdered and well-decomposed chicken manure is used for dressing tobacco seedbeds with excellent success. The manure is spread over after the seed is sown.

Once the beds are formed, sterilized, and fertilized, a suitable shelter is constructed over every bed to protect the beds from heavy rain and strong sunlight. The shelter is raised about a meter in front and seventy centimeters at the rear to facilitate moving about during watering, weeding, and worming. Sheds on seedbeds are important to reduce evaporation, so that more moisture remains in the soil, germination is hastened, and the seedlings protected against heavy rain. In the tropics palm and grass leaves are used for seedbed covers. In the United States the seedbeds are similarly constructed although the width is even more than 6 feet and the area not less than 180 square feet. In the northern districts like Connecticut, substantial frames are built over seedbeds to hold the cloth or glass covers. In some cases, steam pipes are laid in the beds for heating the soil in case of emergency.

Sowing of seeds.—Experience is the safest guide with reference to the right time for sowing.

The chief problem of our growers lies in the rains which may fall too late. Late rains mean late transplanting. The only effective way by which planters can overcome this uncertainty of the weather is the sowing of seedbeds three times more than necessary at intervals of 15 to 20 days, beginning in the middle of August. Seeds must be sown sparsely to avoid thick growth or overcrowding of seedlings as this results in the production of weak seedlings. Thick sowing also predisposes to damping-off disease which is very common in seedbeds.

One gram of seed mixed with sifted carrier, such as sterilized dust or ash, is sown into every square meter of seedbed, or one teaspoonful of seed for every 100 square feet of seedbed. A bed of 10 square meters usually yields not less than 2,000 good seedlings. This method of sowing in the Philippines is similar to that employed in Sumatra. In the United States, Dr. Garner of the Bureau of Plant Industry suggests sowing at the rate of an even teaspoonful of seed to every 100 square feet of bed area and, to secure an even distribution, the seed should be mixed evenly with wood ash. The beds are packed

down after sowing either with a roller or a plank and then covered with cloth, glass or palm leaves. The practice of sprouting or forcing the seeds to germinate before sowing in order to gain an earlier start is not a good one. It is more advantageous for the seed to germinate at the temperature and on the place where it will have to spend its early growth than to hasten germination in an entirely different environment and to transfer it later to the seed plots.

Care of seedlings—After the seeds are sown, they should be watered to keep the soil moist. Too much watering is to be avoided, however, as it causes the soil to harden upon drying. As soon as the seeds have germinated, the beds should be sprinkled regularly every day, but sparingly. When the weather is too windy, watering the beds twice a day becomes very necessary, as evaporation is rapid then and the beds dry up more quickly. The beds should be uncovered occasionally to expose the seedlings to the morning sun in order to harden them. This, too, is necessary to avoid fungus diseases. In the Philippines, it is the practice to remove permanently the sheds of the seed plots 20 to 30 days after sowing, allowing the seedlings to grow in the open as soon as they are strong and big enough to resist strong rain and sunshine. In this way, the seedlings become accustomed to growing under natural field conditions, and, when transplanted in the field, recover very quickly. The beds should be weeded regularly as soon as the seedlings are big enough not to be disturbed or pulled out with the weeds. If worms appear in the seedbed in sufficient abundance to be dangerous, the seedlings should be dusted with calcium arsenate mixed with wood ash in the proportion of one part calcium arsenate to 20 parts wood ash or other suitable carrier. If a solution is used instead of the powder, the calcium arsenate solution should be only of one to two per cent concentration. In either case the seedlings should be dusted or sprayed only sparingly as over application of the arsenical may burn the leaves if not altogether kill the plants, especially if the concentration is quite strong. The flit gun is a handy and cheap sprayer if the use of solution is resorted to. If a hand dusting machine is not available, an ordinary cheesecloth bag will be a good substitute for dusting purposes. The bag is filled with the powder mixture and shaken over the seedlings. This method of dusting was found very practical and quite convenient in the Cagayan Valley.

Preparation of the field.—The field should be plowed at least twice to a depth of over a foot and then thoroughly harrowed to enable the roots of the seedlings to extend well down. Thorough stirring of the soil also conserves the soil moisture, and, at the same time, distributes the fertilizer uniformly. With a well-distributed food supply and sufficient moisture in the soil the growth of the plants will be rapid and normal—conditions which are essential in securing leaves of the finest texture. Slow growth due to improper preparation of the field results in the slow development of the plants, at the same time risking the exposure of the plants to early drought and, what is worse, to the attack of insect pests for a much longer period of time. It may be of interest to consider in this connection the fact that in the Philippines every phase of the work in the field from the clearing of the ground to the curing of the crop is still done by man and animal power, while in the United States and other countries most field operations are performed by machinery.

Transplanting.—Seedlings should be ready for transplanting from 45 to 60 days after sowing, or when they are about 5 or 6 inches high. Seedlings fit for transplanting must be sound, healthy, vigorous, and uniform in size. Great care must be exercised in pulling the seedlings from the beds, as the slightest injury to the stems and roots retard the growth of the plants. If there has been no recent rain to soften the ground sufficiently to make it easy to pull the seedlings, the necessary amount of water must be sprinkled on it before attempting to pull them out. The best time to transplant is after three o'clock in the afternoon. On cloudy days, however, transplanting can go on throughout the day. If the weather is too hot during transplanting, it is necessary that the newly set plants be protected from the sun by covering them for at least three days with banana petioles or other suitable materials. Once transplanting has begun, it should go on uninterruptedly until the whole field is planted. This is very desirable in order to obtain uniformity of the stand. When there is uniform stand, priming is facilitated and a very uniform crop is obtained. The leaves of almost the same maturity are harvested all at the same time. The period of transplanting the different types of tobacco in the different tobacco districts of the country depends upon the climate of the regions but as a general rule transplanting should always commence not later than the month of November. The

cigar filler should be spaced 80 by 70 centimeters. The sun-grown wrapper varieties are spaced 80 by 50 centimeters for the native, and 50 centimeters apart in alternate rows of 80- and 50-centimeter distances quincunx style for the Sumatra varieties; the shade-grown, 80 by 70 centimeters. The Virginia or the aromatic cigarette types are as a rule transplanted as cigar filler tobacco, spaced at 80 by 70 centimeters, while the miscellaneous types are spaced 1 by 1 meter. As a general guide, the distances in planting should depend upon the variety to be planted and the fertility of the soil. In rich lands, spacing can be closer even for the big varieties.

Setting is done either by hand or by machinery. Hand setting is, of course, very simple. The rows and the points where the plants are to be set are marked by sticks or pegs or, better still, the rows are laid by a plow and with the aid of a measuring stick to determine the distances between the plants in the row, the planter starts his planting operation with a dibble. With the dibble, a hole 4 to 6 inches deep is prepared into which the plant is placed perpendicularly up to its neck. The soil is then packed around the plant to give the root a firm hold and at the same time to brace the stem. The newly set plant is then hand-watered and the wet soil covered with dry soil to prevent rapid evaporation and baking. This covering of the wet soil around the plant with dry soil is very important because, if the soil is allowed to bake, it shrinks and subsequently cracks, so that a considerable amount of moisture escapes and at the same time the root system of the plants is strained. The tobacco transplanting machine is a labor-saving device and is now extensively used in the United States. It has its advantages in that the setting of the plant in proper distances, its transplanting, the packing of the soil around the plants, and watering are all done automatically. An ordinary transplanting machine is drawn by two horses and carries a driver and two planters who manipulate all the transplanting operations, each man setting alternate rows. A V-shaped plow makes an opening into which the plant is set and is held in place until the soil around it is packed by means of a pair of paddle-shaped blades which follow the plow. By means of a special gearing on the wheels, definite quantities of water are released at uniform distances. With the transplanting machine much human labor is dispensed with, even in planting large areas.

Replanting should follow after a week, as it never happens that all plants set initially survive. Bigger seedlings should be used in replanting, and there should be enough of these seedlings on hand for the purpose.

Cultivation.—In two or three weeks after transplanting the plant should have fully recovered and cultivation can then begin. Cultivation is necessary in order to keep the soil from hardening or becoming compact. It enables the roots to extend freely and it also eradicates weeds and conserves soil moisture. Cultivation is done either by plowing the space between the rows, or by hoeing to form ridges in the rows of plants. The tooth-cultivator and the tobacco hoer are both great labor-saving devices. Unless weather conditions interfere, the fields should be cultivated every ten days. Three cultivations done thoroughly are sufficient, as by that time the plants will be too big for further cultivation, if growth has been rapid.

The cultivation of open-grown wrapper tobacco, especially in humid regions, should be by banking. That is, the soil is hoed to a maximum depth of 50 centimeters, between alternate pairs of rows and piled to form banks of the other pairs.

Control of tobacco worms.—As the primary object in growing tobacco is to produce sound leaves, one can readily see the importance of vigilant control of all destructive pests of the crop while it is growing in the field. The false budworm, the cutworms and the hornworms are universally admitted to be the most destructive insect enemies of the tobacco plant from the seedbed until the leaf in the field is harvested. It requires an army of worm pickers to keep the worms fully under control. This is accomplished either by hand-picking, by spraying, or by dusting the buds of the plants with arsenicals. Of course, the production of wrapper tobacco under tents minimizes the damage of these worms on the crop but does not entirely check their destructiveness. Calcium and lead arsenate are among the best insecticides for their control. These arsenicals, when used in solution, should be in the correct concentration to avoid the burning of the leaves, otherwise their application would be more destructive than beneficial. In Sumatra, as in the Philippines, calcium or lead arsenate powder was found to be the best for dusting. That is, every 100 grams of sifter or carrier, like wood ash or sterilized road dust, should be mixed with 6 grams of the arsenical powder, or in the proportion of one part powder to 16 parts carrier.

Topping and suckering.—Topping and suckering are two distinct operations having a common end. Topping is the removal of the flower head by pinching, while suckering simply means the removal of all suckers or buds at the axils of the leaves. The work on suckering and topping requires the exercise of some discretion. At or about the time when the plants are beginning to flower, practically all the food materials which are being taken in by the plants are utilized for the nourishment of the flower head and the top leaves. When a plant apparently is not in vigorous condition, it should be topped so that the plant food, instead of being consumed by the flower head and top leaves, can be utilized for the development of the standard leaves. When the plants are vigorous enough, topping ought not to be undertaken since this operation favors the development of coarse, thick leaves. If resorted to, however, it should only be performed when the standard leaves are already harvested. The plants for the production of seed should of course be selected first; then the rest of the plants can be topped. Suckers do not appear abundantly until after topping, so that suckering is a subsequent operation. Suckers deprive the plant of a great deal of food and, therefore, should be removed as soon as they appear. After the standard leaves are harvested, two suckers from the base can be allowed to develop for the production of filler or binder. This crop is usually termed "retoño." Sometimes suckers are allowed to grow when the main plant has been damaged in order to replace the loss.

Harvesting.—Harvesting tobacco in the Philippines is always done by priming, that is, the leaves are picked singly from the stalk as soon as they show the right maturity. It is hard to make a definite rule as to when exactly they are ready for picking. Of course, it is fairly easy to distinguish a mature leaf from a green one, but to harvest a leaf at the proper degree of maturity in order to obtain a good crop and do so throughout a whole harvesting period is a delicate operation. Only by experience does one become a successful operator. An almost uniform color of cured crop is easily obtained if the uniform maturity of leaves is considered upon priming. If a leaf is picked green, it has, when cured, an undesirable dark color and a bitter flavor; when picked overmature, texture and flavor are also affected. Among visible indications of ripening are the slight yellowing of the edges of the leaves, especially at the tip, and the changing of the color of the entire leaf from deep

to light green. Priming on every plant should be done at least once a week. By the adoption of this schedule, it will take from 5 to 8 primings to harvest an ordinary wrapper crop. In the course of priming, the leaves are piled along the rows as the load becomes too heavy to carry along. These piles are in turn gathered into convenient baskets and taken to the curing barn. Great care must be taken in handling the leaves during priming so as to avoid mutilation, breakage, or scratching, since the slightest injury to the leaves is a permanent damage to the finished product. Opinions among tobacco men as to the time of day for the harvesting of tobacco differ. Some growers advocate the harvesting of the crop only during the early hours of the morning, when the plants are not yet actively doing photosynthetic work; it is supposed that the leaves are then in finest condition. On the other hand, other growers contend that harvesting tobacco when the leaves are still wet not only diminishes the gum of the leaves but also causes these to sweat readily, producing an undesirable black color which kills the finish of the leaves and easily brings about decay. For this reason, priming should be done not earlier than 9 o'clock in the morning. The experience of most growers, however, is that in most cases the time of priming need not be limited but can be carried on continuously from morning until afternoon every day. This is the case with big plantations where it takes a week or more to complete the cycle of one priming in a big field. Harvesting goes on irrespective of whether the leaves are wet or dry, or whether it is morning, noon, or afternoon, since to delay the harvesting is far more detrimental to the crop as a whole. The most important thing to remember is that the leaves must be harvested at the proper degree of maturity or ripeness in accordance with the requirement of the type grown.

For cigar filler tobacco, the leaves should be harvested when they have fully bent down, the tips dry or about to be dried and the entire color changed from deep to light green. Wrapper tobacco as a general rule is harvested much greener or less mature than any of the other types. As soon as any sign of change of the deep green color to lighter shade is evident, the leaves should be harvested without delay. The aromatic cigarette types are generally allowed to reach full maturity before they are harvested and this is easily evidenced by the drying of the tips and margins of the leaf and the complete

turning of the green color to almost etiolated yellow. The miscellaneous types are all subjected to early and low topping in order to produce the desirable thick, leathery, and strong crop desired. The sand leaves are harvested as cigar filler after which eight to 12 standard leaves are allowed to remain and mature. In the case of Batek, which is predominantly produced in southern La Union, and northeastern Pangasinan, the leaves are allowed to become overmature until the desired brown spots are prominent. Similarly, the Sulcok, Morado and Catabacuan are created in the same manner as the Batek and although they never develop the spot, the leaves are allowed to become overmature before they are harvested. One precaution that should not be overlooked is to make certain that all leaves are poled on the same day they are harvested. Harvests should not be allowed to lay in big piles overnight because when allowed to do so for a considerable length of time the pile sweats and develops heat that destroys the quality of the finished product. Other than this, there seems to be no valid reason for exactly limiting the hours of harvesting. Neither is wilting a necessary process preparatory to poling or stringing. On the contrary, fresh turgid leaves are easier to handle in poling than wilted ones.

The growing of wrapper leaf tobacco under shade.—The practice of growing wrapper leaf tobacco under shade in the Philippines is an innovation. The bamboo which grows everywhere is used as frame for shelter tents and the leaves of coconut and nipa palms and abaca cloth are cheap materials for shading. As a rule shade frames are erected as early as practicable, at times put up even before transplanting. The shading materials, however, are placed when the plants are about half a meter high. The shading of the field when the plants are still very small should be avoided since it tends to make them tender, weak, and slender. But once the shading is begun, it should go on without interruption; the sooner the shading is completed the better, as a more uniform crop will be obtained thereby. Great care must be observed in equalizing the even thickness of the shade, as uneven shading results in the production of a crop of various degrees of fineness. The posts of the frame must not be less than 2.5 meters high and must be set lengthwise after every 4 rows of plants and crosswise after every 6 to 8 rows. They must be buried deep enough (3 feet) to resist strong winds. In places where palm leaves are not

available the use of talahib (*Saccharum spontaneum*) and cogon grass (*Imperata cylindrica*) is resorted to.

Shading has various effects upon the crop. Partial results obtained in the Philippines show that shading tends to diminish weight, improve burning quality, accelerate growth and maturity, and, above all, render the leaves thin and of a light color. In the United States cheesecloth containing 12 threads to the inch produce higher and better crops than similar material with more or less than 12 threads to the inch. In other words, a shade made of any of the above described materials that approximately allows only 40 per cent sunlight to pass through is the most appropriate shelter tent for obtaining the best results. An experiment is now under way in the Philippines wherein the use of abacá cloth for shading tobacco plantations is being studied. If the experiment proves successful, it will mean an added economy on the part of the growers. The material is cheap, considering the present low price of abacá, and it could be used for a period of three or more seasons.

The shading of wrapper-tobacco fields has many other advantages. It greatly minimizes, if not altogether controls, the Fusarium wilt disease of tobacco. This has been amply demonstrated by the test conducted during the last three years in the wilt-ridden districts of La Union Province. The shaded soil, retains more moisture, and because the soil is not packed by alternate drying and wetting, it remains in better physical condition. The lower temperature in the tent approximately equals the established optimum growing temperature. Furthermore, as Stewart of the U. S. Bureau of Soils claims "there is less variation in the temperature in the tent which is generally recognized as a factor of great importance" (see table 8).

TABLE 8.—*Stewart's observation on the effect of a tent on soil moisture, temperature, relative humidity, and wind velocity*

	Average soil moisture	Average temperature	Average relative humidity	Velocity of wind
	Per cent	*Fahrenheit*	*Per cent*	*Miles per Hr.*
Inside of tent	14.7	72.8	79.0	1.00
Outside of tent	11.6	71.4	71.7	10.00
Difference	3.1	1.4	7.3	9.00

The advantage derived from greatly increased relative humidity of the atmosphere by shading is well defined by eminent German plant physiologists thus:

It acts as a stimulus, and also, by diminishing transpiration, increases turgidity.

The velocity of the wind is very much reduced, which decreases evaporation and protects the plants from being whipped, brushed, or blown down.

Dr. H. Hasselbring, while conducting tobacco experiments in Cuba in 1909, claimed to have found that plants grown in the open absorbed and transpired the greater quantity of water, contained the smaller percentage and the smaller absolute quantity of ash.

Some of the conclusions reached by Sutzer in 1914 show that abundant sunlight, high temperature, liberal nitrogen manuring, and sparing use of water in the soil, produce a large percentage of nicotine; also, that the direct sunlight favors a high potassium but a low chlorine content.

In shade culture the ideal large-sized varieties for wrapper are preferable to the small-sized varieties to compensate for the high cost of production by obtaining a higher yield per unit area.

CURING SHED, CURING OPERATIONS, FERMENTATION, AND PACKING

Successful operation in the field is not a guaranty of a good crop in the end. Poor and inadequate curing sheds, faulty curing, incomplete fermentation and lack of rigid classification are more than enough causes of bringing to the market low-quality crop irrespective of successful accomplishments in the field. To become a successful tobacco producer, every operation pertaining to production from the seed until the crop is packed for the market should be undertaken meticulously and with care. The knowledge to properly comply with the requirements of the different phases of production is only acquired through years of training and experience. That is why the successful tobacco growers of the country are always found among the old growers who grew up with the industry.

Curing.—Curing is not mere drying of the leaves as most people think. The failure of most growers is due mainly to their utter disregard of the rules governing curing-shed operation or the absence of a suitable curing barn. Curing is es-

sentially a life process. This is evidenced by the fact that the protoplasm of the leaf killed by excessively low or high temperature or by chemical treatment like chloroform prevents normal curing. Imperfect curing can not even be corrected by fermentation processes. The chemical changes that take place in curing are the properties of active substances. In a thoroughly air-cured crop, all the starch and reducing sugars disappear and there is a decrease in protein, nicotine, and total nitrogen content. Appreciable quantities of ammonia are formed in the process. The physiological processes during curing are brought about by the aids of diastatic, proteolytic, and deamidizing enzymes and probably also of oxidases. The starvation to which the leaves are subjected leads to an increased secretion of diastase. Thorough and gradual wilting during the initial stages of curing promotes the progress of the process, provided further curing of the leaf is not allowed to proceed too rapidly. Herein lies the danger of applying too much heat; therefore, the application of the same, if resorted to, must be moderate.

Complex chemical reactions take place during curing. They cannot be fully explained at present because knowledge on this phase of chemical and physiological activity is rather scant. It is the general assumption that curing is the getting rid of at least 75 per cent of the water content of the fresh leaves, but this assumption is rather a makeshift explanation to cover the lack of proper understanding of the principles underlying the process of curing.

Before any tobacco is brought in to cure, the curing barn and its surroundings must be thoroughly cleaned, leveled, dried, and disinfected, if necessary. The cleanliness of the curing barn and its surroundings is here emphasized because the occurrence of fungus diseases due to dirtiness, damp soil, etc., often causes the destruction of a large portion of an otherwise good crop. The poled or strung tobacco is admitted and placed on the racks beginning with the highest series until the curing barn is full.

While the general principles underlying the process of curing are true for all types of tobacco, yet the execution of the principles involved in the curing process varies in curing the different types of tobacco. It is, therefore, thought expedient and necessary to discuss the systems of curing, fermenting, classification and packing of different types of tobacco now produced

on a commercial scale in order to give a more thorough knowledge to the growers for their guidance.

1. CIGAR FILLER TYPES

Curing shed.—Any farm barn with good roofing can be utilized for curing cigar filler tobacco so long as it is provided with some kind of wall to protect the crop from rain. It is, however, advisable to build a curing barn particularly for this purpose as it is more economical and more advantageous in the long run. For a curing shed 12 meters long, 6 meters wide and 3 meters high (side wall), enough to accommodate a crop of 1 hectare, an expenditure of around ₱160.00 is necessary as follows:

12	ipil posts, 5 x 5 x 16 ft.	₱64.00
18	apitong, 2 x 5 x 20 ft. (for cepos)	15.00
100	pieces of bamboo for rafters, beam studs, wall frames and braces	15.00
50	bundles of cogon for roofing at ₱0.30	15.00
96	sq. m. rough sawali for walling at ₱0.15 per sq. m.	14.40
300	pieces split rattan	3.00
	Nails and bolts	2.00
100	pieces of bamboo for racks	4.50
	Labor	30.00
	Total	₱162.90

This curing barn will at least last from 6 to 8 years without repair. There are many instances where this type of curing barn never requires any major repair within a period of 12 years.

Poling.—The most common method of poling cigar filler tobacco is by the use of the native stick called "palillo", a pointed bamboo stick about 1 to 1.2 meters long and about a lead pencil in diameter. It can hold from 80 to 100 leaves. The leaves as they are brought to the barn are sorted according to size and soundness after which every class is poled separately. The big sound leaves which are invariably the standards are called "marino" and when already cured are termed "clase superior."

Poling is accomplished by folding the leaves along the midribs so that the ventral side is in and the dorsal side out. Then by piercing the neck of the petiole sidewise with the sharpened end of the stick this operation is repeated until the "palillo" is full to the limit.

The sharpened end is stuck into a small piece of either soft-pithed wood or pummelo skin sliced in cubes. This is done in order to prevent the falling of the leaves which are nearest the sharpened end of the stick. To facilitate sticking, a sword-like thimble made of thin tin or other metal is inserted upon the sharp end of the stick. The thimble pierces the petiole of the leaves sharply without breaking them. The leaves are strung face to face and back to back with a finger's distance in between. This done, the poled leaves are hung on the racks under direct sunshine to wilt for at least three days and at least to start the drying. After three days or so, they are transferred to the racks in the curing barn where by the action of air the crop is allowed to cure until completely dry. The curing lasts from 18 to 22 days depending upon weather conditions. When the mid-ribs are thoroughly desiccated, the sticks are brought down from the racks early in the morning and are piled in *mandalas*. The *mandala* becomes higher as more leaves are cured and piled. The manipulation of the barn during the curing period in the case of cigar filler is practically the same as in the case of curing wrapper tobacco, a phase which will be discussed in detail in this chapter. The leaves in palillo which are now in pile remain thus for two months or more (May to July). During this period the leaves are too brittle to handle; rebuilding the pile is sometimes not advisable. As the rainy season sets in, that is, in August, the tobacco becomes pliant and the bundling of the crop into hands and bunches starts. Once bundled and bunched into hands, they are again built into piles or *mandalas* to continue the fermentation. At this juncture, the farmers will then know more or less how many "fardos" they have and the percentage of "clases" and "cuartas." It is always important that the growers know the percentage of "clases" and "cuartas" in their crop as these will be the basis for bargaining in price when the crop is marketed. The tobacco remains on pile, turned once or twice until the buying season sets in which usually starts with the month of October. Complete fermentation and rigid classification are never done by the growers and seldom do farmers pack their tobacco. These operations (fermentation, classification and packing) are always done by buying firms. The only occasion when growers completely ferment, classify and pack their tobacco is when they decide to ship their tobacco to Manila or other towns to be sold there. When this is done the tobacco is classified and packed in accordance with government regula-

tions usually at 125 kilos (2.5 quintals) or 50 kilos (1 quintal) a bale. The most common material used for baling is the dried sheath of banana stalks. The bale is tied crosswise and lengthwise with split rattan.

2. WRAPPER TYPES

The curing shed.—While substantial farm barns which are spacious and well ventilated may be utilized for curing tobacco, it is always better and more profitable in the long run to have a standard curing shed exclusively for tobacco. This is particularly so in the case of wrappers. As a general requirement, wrapper-tobacco curing sheds should be spacious and the inflow and outflow of air well controlled by an adequate ventilation system. Successful growers in the Philippines have adopted the Sumatra system of curing wrapper tobacco by constructing curing barns with adequate ventilation systems.

The roofing and the sidewalls of the curing shed are made of light materials, like bamboo and nipa palms while the frames are, of course, made of strong lumber. The following is an estimate of materials used in the construction of one curing shed capable of curing a crop of 3 hectares under Philippine conditions:

Dimensions of building—50 m x 2 m x 3 m.

(1) 40 ipil posts (6" x 6" x 12")	₱280.00
(2) 10 ipil center posts (6" x 6" x 25')	140.00
(3) 14 pieces apitong, for grits (3" x 62" x 30')	42.00
(4) 800 pieces big bamboo rafters, beams, studs, wall frames and braces, door and window shutters, tier poles, etc.	120.00
(5) 12,000 nipa "pingot" (shingles) for roofing, walls, windows and door shutters	100.00
(6) 2,000 pieces split rattan for tying	20.00
(7) 5 kilos of 5-inch nails	3.00
(8) 5 kilos of 3-inch nails	3.00
(9) 500 pieces, small bamboo for racks	20.00
(10) Miscellaneous expenses	50.00
(11) Labor	300.00
Total	₱1,078.00

Poling and stringing.—When the leaves are brought to the curing barn, they are laid on the floor or table with great care to avoid folding, scratching, or mutilation. The fresh leaves are poled and strung immediately. If the crop is very uneven

in size and soundness, it is first sorted for such soundness and size preparatory to stringing. The methods of stringing and poling tobacco in Cuba and in the United States are similar. A big needle, a string, and a pole or lath are used. One end of the string is fastened to one end of the pole while the other end is attached to the needle. The needle is passed through the petiole of the leaf in such fashion that the leaves are strung face to face and back to back, allowing two fingers distance between the leaves. A pole four feet long usually contains from 36 to 45 leaves. When the pole is full, the end of the string is tied at the other end of the pole, stretching it well before tying. The strung and poled tobacco is then ready to be hung on the racks at distances of a foot from one another for free circulation of air. The method of poling and stringing wrapper tobacco in Sumatra is the same as that employed in the United States and Cuba.

In tropical regions, wrapper tobacco is cured solely and completely by air in a slow, gradual manner. Freshly hung leaves are allowed to wilt by stopping the ventilation for a period of 3 to 5 days, after which air is allowed to circulate freely. After the wilting period ventilation is allowed every day except on windy and foggy days. In no case, however, should it be allowed at night. Under Philippine conditions, curing is effected in from 24 to 32 days. In temperate countries, as in the Connecticut Valley in the United States, air-curing of wrapper tobacco is aided by artificial heat, either by charcoal braziers or a flue-heating system. This method of curing affords the only practicable means of preventing decay and the attack of leaf molds due to excessive moisture during cold weather. In other words, the curing of wrapper tobacco in cold regions is accomplished by the combined use of artificial heat and ventilation. The application of heat is, however, rigidly regulated, and resorted to only when absolutely necessary. To permit a slow wilting process, the sources of ventilation are closed from three to five days. As the wilting period terminates, the yellowing stage begins, usually lasting from 7 to 10 days. The green color of the leaves gradually turns yellow; this change is regarded as the slow starvation of the leaves. The flow of air and the rate of yellowing must be regulated in order to allow a slow transformation. The last stage, that is, the turning of the yellow color to brown is due to the yellow pigment being oxidized by the action of enzymes found in the cell of the leaf. At this period

the sugar and starch in the leaf disappear, together with some albuminoids and tannins, while the amount of nitrogenous bodies increases. The real drying now begins and must not be retarded until the sap of the midrib, which is the last to dry, is desiccated. The fixing of the color of the crop is also done at this stage. All sources of ventilation should be open daily, if weather conditions permit. When exigencies demand, the charcoal braziers or the heating system may be operated. Rapid drying is desirable to fix the color promptly, as an excess of moisture may likely blacken the crop. This stage lasts from two to three weeks. Ventilation should not be allowed at night as the crop readily absorbs moisture to any amount, and this causes mold and decay. During the curing process the tobacco on the racks should be regularly shaken to throw off the worms that feed on the curing leaves. The last series of racks should not be lower than a meter from the dirt floor. If the barn is floored with either wood or cement, the lowest series of racks can be placed lower than a meter. This precaution prevents the leaves on the lowest racks from absorbing the moisture evaporating from the soil.

Fermentation.—The crop is ready for fermentation when the leaves are well dried and the midribs well desiccated. A thoroughly cured wrapper tobacco must also be in the proper condition or in "good order" before it can be fermented. Very dry tobacco, besides being too brittle to handle, does not develop heat and, therefore, does not ferment readily, while soft tobacco, when piled, is likely to burn due to the almost instantaneous development of excessive heat which moist tobacco can not withstand. Crops ready for fermentation should be neither too dry nor moist but must be pliant to permit handling. This condition can be easily determined by holding a fair-sized bundle of the crop, pressing it firmly with the hand and then relaxing the hold. If the bundle, upon being released, gradually unfolds and slowly returns to its former natural position, it is in good condition for fermentation. If the tobacco remains firm and intact when released, it is too soft for fermentation and should be allowed to dry until the desired pliability is reached. Dry tobacco should never be sprayed with water or exposed to the open air for cooling, but should be hung in the curing barn either in the evening or early in the morning. When the crop is in "good order", it is removed from the poles or palillos and bundled into hands of convenient sizes. The sand leaves,

standards, and tops are bundled separately, and, if the crop is large, fermented separately. A clean closed room, if a separate building is not available, should be used for fermentation. The crop is piled in bulks by sections and turned over regularly at least once for every 4-degree rise in temperature. The object of turning is to reverse the construction of the pile, bringing the top, bottom, and the outside layers into the middle of the new pile. For convenience, the pile should at least be 1,000 to 2,000 kilos. It takes from 6 to 8 weeks to ferment a crop thoroughly. Very fine wrappers require at least 6,000 kilos to ferment perfectly to a maximum of 58° C. (See Appendix A). The object of fermentation is to make the crop more homogenous in color, improve its mellowness, and preserve it from decay. The changes that take place during fermentation, as per table 9, are: (*a*) considerable loss of water and dry matter, (*b*) increase of ammonia, (*c*) decrease of nicotine, (*d*) disappearance of sugar, and (*e*) improvement of flavor and aroma.

TABLE 9.—*Composition of 1,000 pounds of unfermented first wrapper leaves and loss of each ingredient during fermentation (after Jenkins).*

Ingredients	In 1,000 pound unfermented	Left after fermentation	Loss in fermentation
Water	275.0	226.2	48.8
Dry matter	725.0	683.1	41.9
Ash [1]	158.3	147.5	10.8
Nicotine	12.5	10.5	2.0
Nitric acid (HNO_3)	25.9	21.3	4.6
Ammonia (NH_3)	3.3	4.3	31.0
Other nitrogenous matter [2]	113.1	105.6	7.5
Fiber	99.0	94.8	4.2
Other nitrogen:			
Free extract	255.6	244.5	11.1
Ether extract	28.4	26.4	1.8
Starch	28.9	28.0	0.9

[1] Free from carbonic acid and carbon.
[2] Nitrogen other than that of nicotine, nitric acid, and ammonia multiplied by 6¼.
[3] Apparent gain.

Contrary to the popular belief in the agency of bacteria in fermentation, Doctor Loew of the U. S. Department of Agriculture attributes fermentation of tobacco to the action of soluble ferments or enzymes formed in the growing plants and during the wilting period after harvest. He claims that in tobacco fermentation the main changes are the result of chemical action wherein oxygen of the air is made to unite with the various compounds in the leaf. These oxidizing enzymes he calls oxidase

and peroxidase. The oxidase, while a very active oxidizing agent, is readily destroyed or converted into ordinary protein at a temperature of about 152° Fahrenheit, while the peroxidase is more stable. Both, however, disappear after sweating or after fermentation and upon aging. Other workers, however, believe that tobacco fermentation is due to the activity of bacteria which have the ability to produce heat during fermentation. According to Schmidt in the Sudeutsche Tabak Zeitung (Germany, 1925) the *mesentericous* bacteria are found on Ohio tobacco of good quality, and the *coccus* form, on tobacco of poor quality. Experiments conducted by our Bureau of Science have also disclosed the fact that bacteria play an important role in tobacco fermentation. The petuning of tobacco in the United States has possibly no other purpose than to stimulate the growth of or to infect the leaves with the desirable bacteria. While the activity of nonliving ferments (enzymes) in tobacco fermentation cannot be denied, yet the role that bacteria play in tobacco fermentation is hard to ignore. It appears more logical to assume that both enzymes and bacteria activate, if not altogether bring out, the result of fermentation.

Classification and sorting.—Many a good standing crop is spoiled by improper sorting and classification. Classification requires skill, and experienced sorters in a tobacco estate are indeed a great asset. As the tobacco cannot be handled when brittle, the sorting is deferred until the cool season begins, when the crop is pliant enough to be handled. A well lighted or ventilated room is the proper place for classification work, as the different shades of color can thus be easily distinguished. A sorter squats on the floor with his back towards the light. In front of him is a fence of sticks or boards arranged in a semicircle with convenient spaces between the sticks where the classified product is laid in piles. Every space corresponds to a grade or class. Beside the sorter is a pile of the unclassified crop. The sorter takes a bundle, examines it leaf by leaf and places each leaf in its particular section. A glance is sufficient for an experienced sorter to decide to which class a leaf belongs. The various shades of color are easily differentiated by a trained eye. Slight variations in color are, however, less important as a basis in sorting than quality evidenced by fineness of texture and light uniform color combined with strength and elasticity. Whenever a sorter is undecided as to which of two grades a leaf belongs he invariably places the doubtful leaf in the lower grade.

This practice assures the maintenance of a high classification standard which is absolutely necessary in order to preserve the good reputation of the grower. The sorted crop is then graded according to length. All leaves 15 or more inches in length are classified as first class in length; those 12 or over but not more than 15 inches, second class; those 10 or over but not more than 12 inches, third class; and those 8 or over but not more than 10 inches, fourth class. The sorted leaves, in convenient sizes, are finally placed in a fan-shaped fashion and are piled grade by grade and left thus until baled.

In wrapper tobacco classification, the principal criteria are soundness, color, size, fineness, and strength in the order of their importance. As a guide in sorting, the diagram on wrapper tobacco classification in Appendix B may prove helpful.

It is unfortunate that the Philippines has not as yet promulgated official classification standards for locally grown wrapper tobacco. The diagram in Appendix B is proposed by the writers for Philippine conditions. Realizing, however, the tremendous importance of the matter and in order that the authorities or officers concerned may have an actual basis for the preparation of Philippine cigar wrapper standards that will meet universal acceptance, appendices C, D, and E are included in this article showing in full the accepted and official standards and baling methods of Sumatra, Cuba, and the United States.

Baling.—The product ready for shipment is packed and pressed in grass or palm mats, each bale to contain 50 to 80 kilos and to measure 30 inches square and a foot thick. The method of baling is as follows:

A wooden or iron receptacle, consisting of four loose sides without cover, is placed under the press. The mattings are placed at the bottom of the receptacle before the sides are attached. Then the box is filled with tobacco that is already weighed and pressure is applied on the top by means of an iron plate and a screw-like lever. The iron plates press the tobacco until the desired thickness is reached. The sides of the box are removed and the matting placed and sewed with the aid of iron pins. The pressure is released and the package or bale of tobacco is rolled out and labeled accordingly. The bales are stored in the warehouse, where they are fumigated with carbon bisulphide gas to protect them from the attack of beetles. The tobacco is then ready for shipment or for immediate sale.

Stocks of fine grade wrapper tobacco are sometimes stored in ice plants or in sealed tin containers.

3. AROMATIC CIGARETTE TYPES

Curing barn.—The aromatic cigarette types are either sun-cured or flue-cured. The curing of Virginia or the so-called aromatic cigarette tobacco by drying them in the sun is quite satisfactory under Central Luzon conditions but because of uncertain weather it is more advisable to resort to the use of flue-curing barns. A flue-curing barn should either have asbestos sheet roofings, or roofings made of brick or galvanized iron, and the walls should be made of wood. The construction should be so made as to make it practically air-tight. The heating system which should either be made of iron tubes or galvanized sheets must run parallel at the center of the first floor lengthwise and about half a meter high from the ground. The heating system should be provided with a chimney and a draft to control easily the temperature at will. It is always the general rule that the feeding system (fugon) of flue-curing barns be outside the building proper whether the fuel be oil or wood in order to lessen the danger of conflagration.

For a flue-curing barn 6 meters long, 5 meters wide and 5 meters high, the approximate building cost would be around ₱400 itemized as follows:

COST OF CONSTRUCTING ONE FLUE-CURING BARN 6 m x 5 m x 5 m, BIG ENOUGH TO CURE A CROP FROM 2 TO 3 HECTARES.

6 pieces ipil posts	5 x 5 x 16	200 bd. ft. at ₱.16 a bd. ft.	₱32.00
4 pieces apitong	2 x 5 x 20	67 bd. ft.	
6 pieces apitong	2 x 6 x 16	80 bd. ft.	
10 pieces apitong	2 x 5 x 14	117 bd. ft.	
10 pieces apitong	3 x 3 x 20	150 bd. ft.	
10 pieces apitong	2 x 5 x 12	100 bd. ft.	
16 pieces apitong	2 x 3 x 16	128 bd. ft.	
		642 bd. ft. at ₱.06 per bd. ft.	₱37.52
64 pieces tangili (R. siding)	1 x 6 x 20	640	
64 pieces tangili (R. siding)	1 x 6 x 16	512	
		1,152 bd. ft. at ₱.08 per bd. ft.	₱92.16
20 pieces G. I. sheet 12 ft. long No. 28 at ₱2.40 a sheet			48.00
G. I. tubes for heating system			24.00

2 barrels cement	₱9.60
Gravel, 2 cubic meters	5.60
Sand, 1 cubic meter	1.80
Nails, bolts, iron straps	30.00
Miscellaneous	20.00
Labor	100.00
Total cost	₱400.68

This barn is enough to cure a crop from two hectares if planted at one-month intervals.

Poling and curing.—When the leaves are brought to the shed, they are first poled in sticks as in poling cigar filler tobacco. The sticks are full to the limit inasmuch as there is no danger of decay. The leaves are either sun-cured or heat-cured any way. If sun-curing is practiced the poled tobacco is placed on racks constructed in the open and is allowed to stay there until cured. During night time, however, the racks of tobacco should be covered with any suitable material, such as abacá or jute cloth, used mats or canvas to protect them in case it rains or when the atmosphere is too dampy. This cover is, however, removed every morning if the weather is good. If heavy rain is expected the poled tobacco must be brought to the curing barn otherwise if it is allowed to be wet it will spoil. The difficulty in producing good-quality Virginia tobacco by the sun-curing method is therefore evident, especially to big planters.

In flue-curing, the leaves are poled on sticks as described elsewhere but the poled leaves are placed inside the flue-curing barn until this is full to capacity. Once the barn is full the place is closed to allow the tobacco to wilt gradually. When the yellowing stage begins, the flue or the heating system is put into operation, the inside temperature gradually rising as the curing progresses until the whole crop is completely dry but possessing the yellow color. The curing of Virginia tobacco by the action of heat must be done quickly in order to fix the color so desired. Once the yellowing stage has set in the temperature inside the barn must be increased as rapidly as is desirable in order to fix the golden color and at the same time hasten the drying up of the leaves. The highest temperature obtained should be maintained for at least 12 to 16 hours after the leaves are thoroughly dried, in order to give the leaves a

thorough desiccation. After this, the temperature is allowed to go down, first by opening the draft and ventilations and, secondly, by gradually toning down the heat coming from the kiln. When the tobacco has sufficiently cooled down and is already in "good order" it is brought down from the racks, removed from the sticks or palillos, bundled into hands with the use of a leaf of the same kind wrapped at the petiole head of the hands. The crop is then ready for immediate packing either in boxes, bales or in hogsheads as the case may be. The method of curing in North Carolina is given in Appendix F.

Virginia or aromatic cigarette leaf tobacco as a rule should not be fermented because in doing so the yellow color is oxidized and it ultimately turns brown while at the same time the sweet odor or aroma vanishes. It is, therefore, unwise to arrange the cured crop in big piles or mandalas as is done with the other types of tobacco. This precaution should be taken to prevent fermentation.

4. MISCELLANEOUS TYPES

The system and methods of poling, curing, fermenting and packing tobacco, especially the Sulcok, Morado, Batek, and Catabacuan, are practically the same as those for the cigar filler types. Even the variety planted for these two types (miscellaneous and cigar filler) may be the same. The only difference is that some phases of the cultural requirement of the miscellaneous types somewhat deviate from the requirement of the cigar filler types. This is particularly true in the topping operations which are compulsory for the miscellaneous types while they are discretional or even dispensed with in the case of the cigar filler type. Then, too, the leaves of Batek, Sulcok, Morado, and Catabacuan are allowed to mature to overripeness before they are harvested, while those of the cigar filler types are primed when they are of medium maturity.

The sticks for poling cigar filler tobacco can be used for poling tobacco of the miscellaneous type and a suitable curing shed for cigar filler is also suitable for the miscellaneous type. Even the bundling of the crop into hands is practically the same for both types of tobacco.

One of the principal factors which is responsible for the production of poor-quality Philippine tobacco is the utter lack of

adequate standard curing sheds among the tobacco farmers. A great portion of tobacco growers cure their tobacco under their houses or in dilapidated grass huts. Naturally if the crop in the process of curing is subjected to all kinds of adverse conditions, aside from the effects of filthy surroundings, one can not expect to produce a crop of high quality no matter how excellent the crop was while in the field.

YIELD AND COST OF PRODUCTION

The successful growing of tobacco depends largely upon the grower's experience and his ability to keep his cost of production within bounds so as to avoid useless and unnecessary expenditures. This is particularly true in growing the wrapper type which requires a rather high expense outlay. While the secret of growing the cigar filler and the miscellaneous types is rather easy to learn this is not the case when the wrapper and the aromatic cigarette types are grown. The production of wrapper which is exacting in its requirement is a farm enterprise that needs technical skill and plenty of experience. The same is true in the case of the aromatic cigarette tobacco when the flue-curing method is employed or resorted to. The utilization of heat in this case entails danger of conflagration so that the grower must always be very careful and watchful during the curing operation. The production of yellow colors and the task of making this color permanent are problems that require the intelligence of every grower. The absence of this color on Virginia tobacco makes it practically useless.

The yield and cost of producing a hectare of tobacco vary in accordance with the type grown, and with the economic conditions prevailing in the locality. Where the labor wages are high it is almost prohibitive to grow tobacco by administration or by hired labor.

1. *Cigar filler type.*—Referring to table 10, the average cost of producing a hectare of cigar filler tobacco is around ₱229.80, obtaining thereby a gross yield of about 1,250 kilos or 25 gross quintals.

TABLE 10.—*Yield and cost production of one hectare of cigar filler leaf tobacco in the Philippines*

1. Preparation and sowing of seedbeds	September and October
2. Transplanting season	November and December
3. Harvesting season	February to May
4. Distances of planting	80 by 70 centimeters
5. Number of plants to the hectare	17,750
6. Estimated yield per hectare	1,250 kilos or 25 quintals

Items of operation	Man days	Woman days	Animal days	Approximate cost
1. Curing barn of light materials worth ₱150 (6×12 ×3 m.) to last for three years	--------	--------	--------	₱50.00
2. 1,000 sticks or palillos	--------	--------	--------	10.80
3. 200 grams of seed	--------	--------	--------	1.00
4. Preparation and sowing of 20 seedbeds measuring 1 m × 10 m. each	8	--------	8	8.00
5. Rearing of seedlings to transplanting stage	5	10	--------	7.00
6. Preparation of field, 3 plowings and three harrowings	12	--------	12	14.00
7. Transplanting	10	30	--------	17.00
8. Three times cultivation	8	--------	8	9.00
9. Worming, topping, suckering	--------	40	--------	12.00
10. Harvesting	5	60	--------	22.00
11. Poling and sticking	10	80	--------	32.00
12. Barn operation during curing	--------	10	--------	7.00
13. Fermentation	4	10	--------	6.00
14. Bundling and classification	--------	80	--------	24.00
15. Incidentals	--------	--------	--------	10.00
Total expenses	--------	--------	--------	₱229.80

Approximate yield per hectare:

1,250 kilos or 25 quintals at ₱10 per quintal	₱250.00
Total cost production:	
Total expenses per hectare	229.80
Net gain per hectare	₱20.20

At an average price of ₱10 a quintal of filler tobacco, a hectare production would give a gross income of ₱250 or a net gain of ₱20.20. The cost of production as contained in table 10 does not include interest on capital and depreciation of farm implements. Because of the prevailing low prices of filler tobacco, the producers can hardly recover their cost of production if the family labor employed in production is considered. The only reason some farmers keep on growing filler tobacco is that they are able to engage themselves in other occupations while they are waiting for the tobacco to grow to provide for their daily necessities. Whatever little money they derive from the tobacco crop, therefore, means money saved for them.

2. *Wrapper types.*—Tables 11 and 12 show the yield and cost of producing a hectare of shade-grown and open-grown wrapper, respectively, under La Union conditions. To produce a hectare crop of shade-grown wrapper requires an expenditure of about ₱700. A hectare under normal conditions yields around 750 kilos of various grades of wrapper leaf priced at from as low as ₱0.30 to as high as ₱3 a kilo giving a gross return of ₱1,295. The net gain per hectare, therefore, would be around ₱500 to ₱600. In open cultures where the Sumatra varieties are preferred, the cost of production is relatively smaller as expenditure in shading is dispensed with. Furthermore, because these varieties are early maturing, they stay only for a short period in the field thereby minimizing the expenditures involved in field operations. But because the Sumatras are small-leaved varieties, their corresponding yield is also smaller so that the income as compared

TABLE 11.—*Yield and cost of production of one hectare of shade-grown wrapper leaf tobacco in the Philippines*

1. Preparation and sowing of seedbeds	September and October
2. Transplanting season	November and December
3. Shading period	January and February
4. Harvesting season	February to May
5. Planting distances	80 by 70 centimeters
6. Number of plants to the hectare	17,750
7. Estimated yield per hectare	750 kilos all grades

Items of operation	Approximate cost
1. Seedbed and rearing of seedlings	₱8.00
2. Preparation of field, 3 plowings, 3 harrowings	25.00
3. Transplanting	16.00
4. Cost of shading materials	200.00
5. Erecting shelter tent	40.00
6. Worming	20.00
7. Cultivation and weeding	15.00
8. Priming and poling	80.00
9. Curing and fermentation	15.00
10. Classification and bundling	100.00
11. Baling and baling materials	25.00
12. Depreciation of curing barn	60.00
13. Miscellaneous expenses	20.00
14. Supervision	80.00
Total expenditures per hectare	₱704.00

Approximate yield per hectare:

200 kilos at ₱3 a kilo	₱600.00	
200 kilos at ₱2 a kilo	400.00	
100 kilos at ₱1.50 a kilo	150.00	₱1,295.00
100 kilos at ₱1 a kilo	100.00	
150 kilos at ₱0.30 a kilo	45.00	
Net income per hectare		₱591.00

TABLE 12.—*Yield and cost of production of one hectare of open-grown wrapper in the Philippines by planting either the Sumatra varieties, the promising hybrids of F_1 generation hybrids.*

1. Preparation and sowing of seedbeds .... September and October
2. Transplanting season .... November and December
3. Harvesting period .... January to April
4. Planting distances .... 80 by 50 centimeters
5. Number of plants to the hectare 25,000
6. Estimated yield per hectare .... 750 kilos all grades

Items of operation	Approximate cost
1. Seedbed materials, palillos and others	₱12.00
2. Preparation of field, 3 plowings, 3 harrowings	25.00
3. Rearing of seedlings up to maturity	40.00
4. Worm control	20.00
5. Harvesting and stringing	80.00
6. Curing	30.00
7. Fermentation	12.00
8. Classification and bundling	50.00
9. Baling and baling materials	25.00
10. Depreciation of curing barn	60.00
11. Incidentals	30.00
12. Supervision	40.00
Total expenditures per hectare	₱424.00

Approximate yield per hectare:

150 kilos at ₱2 a kilo	₱300.00	₱630.00
200 kilos at ₱1 a kilo	200.00	
200 kilos at ₱0.50 a kilo	100.00	
100 kilos at ₱0.30 a kilo	30.00	
Net income to the hectare		₱206.00

with that from shade-grown wrapper is also proportionately smaller. In the Philippines among the locally produced wrapper crop, the shade-grown is better priced than the open-grown so that the discrepancy in the ultimate income is always on the side of the open-grown crop. The gross yield of open-grown Sumatra is around 650 kilos of various grades with prices ranging from ₱0.30 to ₱2 a kilo. One is likely to presume that a much higher yield should result from the open-grown Sumatra than from the native shade-grown as the open-grown crop is heavier than the shaded. While this certainly is the case, yet because of the small size and smaller number of harvestable wrapper leaves from the Sumatra variety the result is that the native shade-grown generally outyields the open-grown Sumatra. And because the shade-grown native varieties are generally of a higher quality, better prices are obtained for them. The average cost of production per hectare of open-grown Sumatra wrap-

per is around ₱424. The total gross profit is around ₱630 or a net profit of around ₱206 per hectare. The growing of the Sumatra varieties and of the promising hybrids is suitable in places where the climate is mild during the growing season. That is in places with an almost even distribution of rainfall as in Davao and Cotabato and the southern districts of Laguna. The growing of wrapper under shade is only practicable in regions with distinct dry and wet seasons as in the Ilocos region and Central Luzon and possibly also in districts with short dry periods as the Cagayan Valley. The important advantages derived from shading are finer leaves with lighter and more uniform color.

3. *Aromatic cigarette type.*—The Virginia and the Turkish varieties which fall under the aromatic cigarette type or bright group are distinctly of foreign origin. They are grown purposely for the production of yellow leaves which are utilized for the manufacture of aromatic cigarettes. There are not many appreciative differences in their culture with the cigar filler tobacco with the exception, however, that the bright group is harvested more mature than the cigar filler varieties. The principal differences lie in the method of curing and fermentation and in the preparation of the product for the market.

The aromatic cigarette types are either sun-cured or flue-cured. As seen in table 13 the costs of production per hectare of sun-cured and flue-cured cigarette tobacco of the aromatic type are ₱195 and ₱225, respectively. The apparent bigger expense involved under the flue-cured system of curing is due to the added expense in building a flue-curing barn and the fuel consumption for the operation of the barn. The yield and consequently the net income derived from a unit area vary in accordance with the variety grown. The Virginia varieties under similar conditions always give higher yield than the Turkish varieties because of the diminutive size of the latter. Then again the qualities of the crops produced under the two methods of curing are quite different, the flue-cured being always of a better quality than the sun-cured.

TABLE 13.—*Yield and cost of production of one hectare of aromatic cigarette leaf tobacco in the Philippines*

(SUN-CURED)

1. Preparation and sowing of seedbeds .... September and October
2. Transplanting season .... November and December
3. Harvesting season .... February to April
4. Planting distances:
   For Virginia varieties .... 80 by 70 centimeters
   For Turkish varieties .... 80 by 50 centimeters
5. Number of plants to the hectare:
   For Virginia varieties 17,750
   For Turkish varieties 25,000
6. Estimated yield per hectare:
   For Virginia varieties .... 1,100 kilos or 20 quintals
   For Turkish varieties .... 400 kilos or 8 quintals

Items of operation	Approximate cost
1. Seedbed materials, palillos and others	₱10.00
2. Preparation of field, 3 plowings and 3 harrowings	25.00
3. Rearing of plants from transplanting to maturity	60.00
4. Harvesting and sticking	35.00
5. Curing	15.00
6. Packing and packing materials	30.00
7. Incidentals	20.00
Total expenditures	₱195.00
Approximate yield per hectare:	
For Virginia varieties—20 quintals at ₱15 a quintal	300.00
For Turkish varieties—8 quintals at ₱30 a quintal	240.00
Estimated net income:	
For Virginia varieties	105.00
For Turkish varieties	45.00
(FLUE-CURED)	
1. Seedbed materials, palillos and others	10.00
2. Field preparation, 3 plowings, 3 harrowings	25.00
3. Rearing of plants from transplanting to maturity	60.00
4. Harvesting and sticking	35.00
5. Curing including fuel cost and barn operation	45.00
6. Packing and packing materials	30.00
7. Incidentals	20.00
8. Depreciation of flue-curing barn	30.00
Total expenditures	₱255.00
Approximate yield:	
For Virginia varieties—20 quintals at ₱20 a quintal	400.00
For Turkish varieties—8 quintals at ₱40 a quintal	320.00
Estimated net income:	
For Virginia varieties	145.00
For Turkish varieties	65.00

The gross yield per hectare of Virginia sun-cured under Central Luzon conditions is about 20 quintals; of the Turkish variety, only 8 quintals. While the price for Turkish is relatively

much higher than that for the Virginias, yet the ultimate net profit is always more for the Virginia than the Turkish variety. According to table 13, the net profit per hectare of sun-cured Virginia is around ₱105 and that for Turkish, only around ₱45. For these two crops when cured by flue the average cost of production per hectare is ₱255, the net gain derived therefrom being ₱145 for Virginia and about ₱65 for Turkish.

The production of the aromatic cigarette type of tobacco in the Philippines is still on an experimental stage and, therefore, the production values as utilized in this paper are experimental data. The commercial production of this type of tobacco will greatly depend upon the favorable reaction of the local tobacco factories towards the locally produced bright tobacco. That it can be produced here is no longer to be doubted.

4. *Miscellaneous types.*—The Morado, Sulcok, Catabacuan, and the Batek tobacco which are grouped under the miscellaneous type are chewing tobaccos. Their principal utility, however, at the present time, is for smoking—principally by the members of the older generation. The most important in this group, and which has a standing in commerce, is the Batek tobacco. This is produced on a big scale in La Union and in northeastern Pangasinan. Because of the dominant position of the Batek tobacco under the miscellaneous type, it is here used as a representative of this type in the discussion of production cost and yield values.

The average cost of producing a hectare of Batek tobacco under La Union and Pangasinan conditions is around ₱212.50, giving a gross yield of 12 quintals Batek and 8 quintals cigar filler crop. The cigar filler crop is derived from the sand and the sucker leaves. At the average price of ₱20 and ₱5 a quintal each of Batek and cigar filler, respectively, a hectare of Batek tobacco can yield a gross return of around ₱312; and if the cost of production is ₱212.50 per hectare the net profit would be around ₱99.50 to the hectare.

The planting of the miscellaneous type of tobacco on a very extensive scale is problematical because the demand is purely local and this local demand is not even big. The big tobacco factories do not buy this type of tobacco as it has no commercial utility among the present factory products. Unless the tobacco manufacturing industry embarks on the manufacture of chewing tobacco, there seems to be insufficient reasons to warrant the extensive planting of this type, outside of the area we now have in cultivation.

TABLE 14.—*Yield and cost of production of one hectare of (miscellaneous type) Batek leaf tobacco in the Philippines*

1. Preparation and sowing of seedbeds	September and October
2. Transplanting season	November and December
3. Harvesting season	March to May
4. Distances of planting	1 m. by 80 centimeters
5. Number of plants to the hectare	12,500
6. Estimated yield per hectare:	
Batek	12 quintals or 600 kilos
Liso or cigar filler	8 quintals or 400 kilos

Items of operation	Man days	Woman days	Animal days	Approximate cost
1. Curing barn of light materials worth ₱150 (6 × 12 × 3 m.) to last for three years	--------	--------	--------	₱50.00
2. 1,000 sticks or palillos	--------	--------	--------	10.00
3. 200 grams of seed	--------	--------	--------	1.00
4. Preparation and sowing of 18 seedbeds each of 10 sq. m. area	7	--------	7	7.00
5. Rearing of seedlings to transplanting stage	4	8	--------	6.00
6. Preparation of field, three plowings and three harrowings	12	--------	12	14.00
7. Transplanting	8	28	--------	13.20
8. Three times cultivation and weeding	8	--------	8	9.60
9. Worming, topping and suckering	--------	35	--------	10.50
10. Harvesting	5	60	--------	22.00
11. Poling and sticking	10	80	--------	32.00
12. Barn operation during curing	--------	10	--------	7.00
13. Fermentation	4	10	--------	6.20
14. Bundling and classification	--------	80	--------	24.00
15. Incidentals	--------	--------	--------	----------
Total expenses	--------	--------	--------	₱212.50

Estimated yield per hectare:

12 quintals Batek (600 kilos) at ₱20 a quintal	₱240.00	312.00
8 quintals cigar filler (400 kilos) at ₱9 a quintal	72.00	
Net gain per hectare		₱99.50

TOBACCO PESTS AND DISEASES

The production of high-yielding and good-quality tobacco has become more difficult in spite of the increased knowledge acquired by growers through experience and experimentation. This difficulty is in a great measure due to the increasing prevalence of tobacco pests and diseases. While new areas for tobacco culture are being opened, the important tobacco districts of the world remain unchanged in location, which simply means that a greater portion of the total area planted to tobacco is intensively and continuously planted to this crop every year. Diseases and pests in these constantly used soils naturally accumulate. It is hard to make an exact estimate of the damage

done by diseases and pests to the tobacco industry, but one can get an idea of how tremendous it must be when it is considered that in the United States the loss due to root rot alone in a certain year amounts to about ₱20,000,000. It is conservatively estimated that the United States loses about ₱50,000,000 of the total value of her tobacco crop annually. In the Philippines, or to be specific, in the province of La Union, approximately one-third of the supposed normal production is destroyed by the tobacco wilt disease, which means a loss of about ₱800,000 yearly to the province. The most common diseases and pests of tobacco are hereby enumerated, together with causes, when known, and the possible methods of control.

TOBACCO PESTS

From a survey of the various available papers on tobacco insect pests it appears that in tropical as well as in semitropical tobacco regions the damage done by insects is considerably greater than in temperate regions, like the Connecticut Valley. Insect attacks begin almost as soon as the seedlings appear and do not cease until the tobacco is consumed. The damage is mainly of four kinds and may be classified in the following manner:

1. Injury to roots and stems;
2. Leaves eaten or ruined;
3. Leaves punctured by sucking insects;
4. Dried tobacco eaten.

Cutworms.—These insects do vastly more damage to tobacco than all others put together, making it necessary to reset the field or to set nursing plants many times. The latter plan tends to give the crop uneven maturity and quality of harvest.

Cutworms are caterpillars of a number of species of the owlet moth, belonging chiefly to the genera *Peridromia, Agrotis, Feltia, Chloridea, Plusia* and *Prodenia.* Most species have but one brood a year. The eggs are laid on grasses late in summer. The worms as they hatch feed on plants, going deeper into the soil as colder weather comes. In the spring they come out and feed on plants of many kinds. Later they take on the chrysalid form in the ground and emerge as moths. The worms feed at night and spend the day in the ground or under clods or rubbish. In the tropics their life cycles are virtually uninterrupted. The caterpilar of the genus *Chloridea* is better known as the false budworm.

Late fall plowing uncovers many worms which are eaten by birds, and also kills the plant growth which is their early spring food. Undoubtedly rye and other cover crops favor their presence in the field. The best poison bait for them is one pound Paris green to 100 pounds of bran, a pint or more of molasses and enough water to moisten the whole which is thoroughly mixed. The mash is strewn over the field a few days before setting out the plants or placed on rows where the plants are to be set out. This will kill most of the worms which are ready to attack the crops.

Some growers have found it worth while to put a pinch of this mash near each plant when set and claim that it gives perfect protection. This, however, involves a great deal of labor.

In the tropics as discussed in a preceding chapter, hand picking is the most practical means of control especially when labor is cheap and abundant. One to two per cent solution of either calcium or lead arsenate spray in the seedbeds and on the growing plants in the field is also practical, especially when labor is rather scarce or expensive. Dusting with the same insecticides is preferable as the plants become older.

A parasitic hymenoptera (*Microplitis* sp.) attacks the larvae of the genus *Chloridea* while those of the *Prodenia* are attacked by a tachinid fly. A hemipterous insect (*Enagoras* sp.) attacks the larvae of both genera.

Wireworms (*Melanotus cribulosus Lee and Asaphes* sp.).—These are the larvae of the click beetles (*Elateridae*) and unlike cutworms can work their way into the vegetable matter. Occasionally they do serious damage, attacking both the roots and the base of the stem. The worm lives for at least three years underground, transforming there after midsummer of the third season in earthen cells. The adult beetles emerge the following spring.

The only suggested remedy is stirring the soil in late summer and fall, a practice which breaks the cells and kills many of the adults. In Cuba drenching the furrows at planting time is the method used to check the pest.

Tobacco hornworms (*Acherontia lachesis and Phlegethontius quinquemaculata* How.).—These worms are caterpillars of sphinx or hawk moths and are more destructive than any other insects attacking tobacco, excepting cutworms in the United States. The eggs are laid singly on the under side of the leaves by the adults which fly only at dusk. The egg seldom hatches before

July into a worm or caterpillar which eats tobacco leaves voraciously until harvest time. The full-grown caterpillar goes into the ground and assumes its pupal or chrysalid form a few inches below the surface to emerge as a moth the next spring. An important natural enemy is a small four-winged fly which lays eggs in the worm. Its larvae develop there and fasten their cocoons on the back of the caterpillar. A worm thus attacked dies before transplanting.

The only control practiced in Connecticut is hand-picking. German of Kentucky has shown that one pound of Paris green in 160 gallons of water does not injure the leaf and spraying is practiced somewhat in Kentucky and also in Florida where lead arsenate is used which cannot kill the leaves and adheres to them better than Paris green. In the tropics the larvae of the sphinx moth is held in check by certain parasitic flies.

Grasshoppers, tree crickets, etc.—Tobacco is often severely damaged by various species of *Orthoptera*. The leaves injured by grasshoppers have holes in them, or perhaps the edges are eaten, the injury being larger than flea-beetle injuries, but usually smaller than those caused by hornworms.

As a rule the plants on the outside rows, especially when near grasses, weeds, or brushes, are damaged more seriously than the plants in the center of the field. Certain of these insects make their way to the middle of the field and there feed upon the plants, like the Carolina locust (*Dissosteira carolina* Linn.), the common brown species. The red-legged grasshopper (*Melanoplus femur-rubrum* DeG.) is common in Connecticut, and has been observed to feed on tobacco. *M. atlantis* Riley and *M. differtiales* Thos, have also been reported in southern United States.

Tree crickets are sometimes injurious around the edges of the field. The commonest is the four-spotted cricket (*Oecanthus quadripunctatus* Bent) though the striped tree cricket *O. fasciatus* Fitch is also found to feed on tobacco.

Other species of *Orthoptera* attacking tobacco in Connecticut are the Texas katydid, *Scudderia texensis* Sanspictet; *S. septentrionalis* Serv.; slender meadow grasshopper, *Xipidium fasciatum* DeG. and the short-winged meadow grasshopper, *X. brevipene* Scudd.

Tobacco stem borer (*Gnorimoschema heliopa*).—This is a very serious pest of tobacco, attacking mostly young plants and water sprouts. The young larvae bore throughout almost the entire length of the young stem which eventually swells.

Obviously the stem borer cannot be controlled by poisons since it is well hidden, but by insuring the rapid growth of the seedlings thus minimizing their life in the seedbeds infestation is likewise minimized. In the field, vigorous plants can survive an operation with a sharp knife to kill the larvae. Otherwise the plants that are badly infested should be removed and destroyed.

Tobacco splitworm (*Phthorimaea* (*Gelechia*) *operculella* Zell.).—This insect is an important pest in southern United States. The adult insect is a minute, grayish moth laying its eggs upon the leaves. The minute caterpillar bores between the surfaces of the leaf making a flat mine, often of considerable size with a gray discoloration visible from both sides of the leaf. There are two or more generations in the course of the summer, and the insect is more noticeable in autumn.

It has been shown that in Florida this leaf miner when feeding does not pass its entire life in one place, but after a while gnaws to the outside, and then crawling around over the leaf, will finally enter tissue again in a new place. Because of this habit of the insect, it can be controlled by an arsenical spray. And since the early generation of the insect is passed in some other food plants like the horse nettle and possibly the nightshade and the Jimson weed, it is recommended that these weeds be destroyed. Clean culture is also advisable.

The new tobacco bug or suck fly (*Dicyphus minimus* Uhler).—This insect is not only new as a tobacco enemy but is new to science. In Florida, it is considered as a serious enemy of the crop. While the first crop may not be generally damaged, the second as well as late tobacco crops are frequently quite destroyed.

The insects damage the leaves by sucking the cell sap through their beaks. The infested leaves soon become yellowish in color and somewhat wilted, and the older leaves eventually split in places. These conditions render proper curing difficult if not impossible.

The eggs are deposited singly, mainly in the smaller veinlets, hatching after about four days. The entire life cycle of the insect is supposed to be only about 15 days.

A thorough cleaning of the fields and burning of the trash in autumn are measures which should be adopted when the insects are abundant. The Florida Agricultural Experiment Station has found that a concentrated solution of nicotine, diluted with sixty parts of water, will kill a large proportion of the

full-grown as well as many of the young. Spraying should be done in the morning when the insects are less active. Early set trap plants may concentrate the hibernating bugs so that they can be readily killed.

Other sucking bugs (Stink bugs).—There are several true bugs known to suck tobacco juice, causing a shrivelling or drying of the leaf but so far none have been observed to be serious enemies of the tobacco crop.

One of the commonest of these bugs is *Precilacystus diffusus* Uhler. This insect is found at all seasons of the year and it really becomes a little menace when very abundant. Another species is the green bug, *Euschistus variolarius*. It has been reported as quite important in Kentucky. An interesting little bug of the family *Scutelleridae, Corimelaena extensa,* has been found of little importance also at Cedar Ranch, Arizona.

It is possible that in the course of time either by a developing habit or by an increasing abundance of any or all of these bugs, they may become very important pests of tobacco. At all events, the bugs may be controlled by the same remedies as recommended against the suck fly.

The budworms (Heliothis rhexia S. and A. Heliothis armiger Hubn).—These are two distinct and rather similar insects known as budworms. *Heliothis rhexia,* thus far, is found only to occur in the Southern States and the tropics. The adult insect is a small greenish moth. Its caterpillar is nearly always found in the bud of the tobacco plant about the time of topping. It is usually late in its appearance, that is, it is most likely to be damaging the latter part of the tobacco season. The insect feeds on other plants mostly of the nightshade or solanaceous group.

The false budworm *H. armiger,* sometimes called "fall worm", is not distinctly a tobacco insect, attacking the tobacco only when its favorite food plants are not abundant. The insect prefers cotton, tomato, and corn especially.

The insect is rather variable, its worms varying from light green, without spot or stripe to nearly black in color. When attacking the tobacco plant, the buds are the principal parts damaged although the leaves are also eaten to a certain extent.

The arsenical spray recommended for flea beetles is applicable to the control of these budworms, but in Florida Prof. Quaintance recommends the sprinkling in the bud of a thoroughly mixed fairly finely ground corn meal (a quart) and Paris green

($\frac{1}{2}$ teaspoonful). Clean culture, careful attention to corn and tomatoes growing in the vicinity and late fall plowing to break the little earthen pupal cells of the insects are recommended.

Other tobacco leaf and stem feeders.—The so-called cabbage looper, *Autographa brassicae* Riley, is a noctuid moth which in the larval stage feeds chiefly on cabbage and related plants but has been found in Maryland tobacco fields, although not in sufficient numbers, to make it important. This particular species is readily destroyed by arsenical spray.

Mamestra legitisnea is an insect which is allied to the cutworms and feeds exposed upon the foliage of different plants. Its larva is a very handsome caterpillar, bright yellow in color with velvety-black longitudinal lines. Thus far it has only been observed as a tobacco insect in southern Virginia. It is also easily destroyed by arsenical spray.

The tobacco thrips (*Thrips tabaci* Lindemann).—This minute insect is primarily an onion pest, and attacks the tobacco in Europe. Recently there has appeared in Florida, Georgia, and Texas another species of thrips (*Euthrips nicotianae* Hinds), which according to Hooker of the U. S. Department of Agriculture Bureau of Entomology does much damage to shade-grown cigar wrapper tobacco by sucking out the sap from the veins on the upper surface of the leaf, giving the veins and veinlets a whitish color which shows in the cured tobacco. Hooker recommends clean cultivation of the field between crops and spraying the plants twice a week, beginning while they are in the seedbeds.

The "white fly" of tobacco (*Aleyrodes tabaci* Germadices).—One of the insects especially noticeable in Europe is a minute form which looks like a small scale insect on the under side of the leaf. The species found in the United States (*Aleyrodes vapriarum* Westwood) has not been observed definitely in tobacco fields but because it has always been found to attack tobacco in experimental plots, it is very probable that sooner or later it will be found in the fields too. The larvae are nearly white or yellow and are attached to the leaf like scale insects. Spraying the under surface of the leaves with soap and water (one pound in eight gallons) should be resorted to in order to destroy those which hatch from the eggs after the previous application.

Plant lice (*Nectarophora tabaci*).—Green plant lice are occasionally found on the under side of the leaves, especially the

terminal leaves, although in Connecticut they have been observed on the older leaves. These insects do little damage, however. A spray of one pound of laundry soap dissolved in eight gallons of water should kill the lice. Nicotine sulphate is more effective.

The mealy bug (*Dactylopius citiri* Risso).—The common mealy bug has been observed in greenhouses, at Washington, D. C., to thrive and multiply alarmingly upon tobacco plants. It has not been recorded thus far, however, in open fields.

The twelve-spotted Driabotica or "corn root worm" (*Driabotica 12-punctata* Fabr.).—This insect is commonly found on tobacco in Connecticut, and injures it slightly by boring small holes in the leaves. It is also observed in Kentucky. It is not a dangerous tobacco insect, however.

Slug (*Limax campestris* Binney) *and allied species.*—Plants in seedbeds and sometimes recently transplanted seedlings are occasionally damaged by slugs. Arsenical poison can easily be used.

The tarnished plant bug (*Lygus pratensis* Linn.).—This insect has been found on tobacco in Connecticut and is thought to do more or less injury. Thus far, however, nothing very definite regarding the economic importance of the insect as a tobacco pest has been established.

The tobacco stalk weevil or pith worm (*Trichobaris mucorea* Lec).—This beetle tunnels in the leaf stalks and in the main stem, often going down into the root. It is closely related to the corculionid potato stalk weevil (*T. trinotata* Say.). As soon as the crop showing the presence of this pest is harvested all the stalk and rubbish should be burned.

Stalk borers (*Papaipema nitela* Guen).—This is another insect which may attack tobacco. It tunnels in the pith of the stems of potatoes, tomatoes, and other garden crops. The adult is a mouse colored moth. Evidence of the pest should prompt clean cultivation and removal and burning of old stalks.

Tenebrionid beetle (*Opatum intermideum*).—This insect is considered as a tobacco pest in Russia, attacking the stems underground.

There is still a considerable number of insects observed on tobacco in the field that are not mentioned in this chapter, but they are insignificant and are hardly worthy of the grower's attention.

The cigarette beetle (*Lasioderma serricorne* Fabr.).—Stored tobacco, cigars, and cigarettes are frequently attacked by in-

sects and injured to a greater or less extent. The chief depredator is a small beetle of the family *Ptinidae,* bearing the Latin name *L. serricorne* Fabr. This beetle breeds in tobacco and many other dried vegetable products. This, of course, ruins cigars and cigarettes, or, if leaf tobacco is attacked, spoils it for wrapping purposes. Fumigating with carbon bisulphide, or steaming the tobacco, will destroy the insect in all its stages.

In fumigating with bisulphide, every precaution should be taken to see that the room is perfectly air-tight, and also that no fire is allowed to enter the room until it has been most thoroughly aired. The vapor of carbon bisulphide in confinement is inflammable and explosive. One ounce of the liquid should be evaporated for every 62½ cubic feet of space, or one pound for every 1,000 cubic feet.

Cellophane wrappers have contributed much recently in protecting cigars and other manufactured tobacco products from the beetle.

Of particular interest is the fact that a little four-winged fly (*Catalaceous anthonomi* Ashmead) is parasitic on the cigarette beetle, laying its eggs in the larvae of the beetle. While the parasitic work of the fly is not very great, it nevertheless keeps in check the rapid multiplication of the pest.

Other beetles known occasionally to infest dried tobacco are the drug store beetle (*Sitodrepa panicea* Linn.), the leather beetle (*Dermestes vulpinus* Fabr.) and the rice weevil (*Calandra oryzae* Linn.). Remedies are the same as for the cigarette beetle.

TOBACCO DISEASES

Damping-off (*Rhizoctonia solani, Phytophthora nicotiana, Sclerotium rolfsii* and *Pythium debaryanum*).—Damping-off is a disease in the plant beds commonly caused by four fungi of the genera *Pythium, Phytophthora, Sclerotium* and *Rhizoctonia.* The symptoms of the diseases caused by these four fungi are identical, but upon microscopic examination the difference can be easily determined in that the mycelium of *Pythium debaryanum* is nonseptate while that of *Rhizoctonia solani* is septate. Wet soils, abundance of organic matter, high humidity and poor ventilation of seedbeds, are the principal factors that favor damping-off diseases. The disease can be avoided by sparse seeding and by utilizing new land for seedbed purposes. If old lands are used for seedbeds they should be thoroughly steril-

ized. A good drainage is an essential factor that should not be overlooked. The shed of the plot beds should be removed occasionally during good weather and the beds should be watered thoroughly but not too frequently. If only patches are infected, these spots should be scraped off (seedlings and soil) and the areas sprayed with 1:50 formaldehyde solution.

Seedling stem rot.—While the general effect on the seedlings of the fungus causing seedling stem rot is the same as that caused by the damping-off fungus, the causal organism, however, is entirely different, because of the presence of white fungus threads creeping over the decayed plants. The remedies are the same as the means employed against the damping-off trouble.

Root rot (*Thielavia basicola* (B & Br.) Zaptf.).—Root rot is another fungus disease causing rotting of seedlings in the beds and poor stand of plants in the field. This disease is limited to the root system so that symptoms above ground are marked by stunted growth and chlorotic appearance. Generally the symptoms above ground resemble those caused by food deficiency. The only way to distinguish root rot is to examine the root system of the plants. As this disease can stay in the ground for a considerable length of time it is best to practice rotation in highly infected ground. Low soil temperature favors the occurrence of root rot. Root rot in seedbeds can be avoided by using new land for seed plots, or, if old lands are used, these should be thoroughly sterilized. The transplanting of seedlings that are infected with root rot should be avoided, and if sufficient ground is available heavily infected ground should be fallowed for at least two or three years. The planting of resistant varieties cannot be overemphasized.

Sumatra disease (*bacterial*).—This trouble appeared on Sumatra plants in Connecticut in 1907 and caused severe injury. The disease is different from damping-off troubles and root rot because the injury includes the base of the stem and the root immediately below it. It has not been seen yet on the variety Havana or Broadleaf. While the disease has not as yet been definitely identified, actual available evidences seem to show that it is bacterial.

Canker (*bacterial*).—Canker shows as a girdling of the stem underground of a diseased area on the stem above. In the latter case there is a dark brown sunken area in the bark, sharply marked off from the healthy green bark. While other

diseases or even insect injuries may be the starting point of the disease, the canker itself is probably of bacterial origin. Till now it has not been common enough to do serious damage. Heavy manuring seems to favor the development of this disease.

Mosaic or calico.—The mosaic disease is characterized by crinkling and by the molted condition of the leaves. The diseased areas either appear lighter or darker in color than the healthy portion and are rough to the touch. The causal organism is so far not known and it has never been possible to demonstrate the presence of either bacteria or fungi in the tissues of any part of the affected plant. Until more is known about the action of the so-called ultramicroscopic organisms, the disease cannot be ascribed to an organism of that class.

Owing to the nature of the disease the matter of absolute prevention and control is difficult, but with careful attention to details of sterilization of the seedbed and handling of the seedlings at transplanting and worming time a large percentage of infection can be avoided. The hands should always be washed after touching calicoed plants, and in worming separate workers or worm pickers should be assigned to pick worms only on affected plants. Mosaic or calico appears on plants of any stage, young and old alike, but the disease seems to be more ravaging when the plants are about to flower.

Frenching (nutritional deficiency).—The frenching disease is frequently confused with mosaic and at times both are considered as one and the same thing. This confusion is due to the identical symptoms exhibited by affected plants during the early stage of either disease. The early signs of the appearance of frenching are like the early stages of mosaic. It is only when the disease is approaching the severe stage that real frenching habits are manifested. Plants attacked by frenching are weak and very brittle. The leaves of severely attacked plants become narrow and ribbon-like. In many cases the leaf buds grow in bunches, and are toothpick-like and stringy. The upper surface of the leaves shows yellow spots, and the leaves are thicker than normal. When this disease appears in the seedbed, the seedlings could hardly be recognized as tobacco seedlings, due to the stringy and toothpick-like leaves almost without any visible internodes.

The disease may appear at any stage of the development of the plants and oftentimes occurs when the plants are at the

flowering and suckering stages. This disease is not infectious and, therefore, is not a germ disease but is due to malnutrition. Deficiency of nitrogen in the soil, defective drainage, wet soil and poor cultivation are the factors that may bring about the incidence of frenching. This disease was successfully controlled in La Union Province by the application of nitrogenous fertilizers. This disease has been the subject of intensive investigations in the United States and was found to be due to nitrogen deficiency in the soil. It has been observed that under Isabela conditions diseased seedlings when grown in rich alluvial soils grow into normal plants even without fertilizer application. The affected plant recovers although the frenched leaves do not become normal. As the plant grows the subsequent leaves develop into normal ones and by the time the plant has become big enough the disease will have left absolutely no trace. Highly inclined grounds when not properly terraced to prevent soil washings due to heavy rains are likely to produce frenched seedlings. Old land for seedbeds must be adequately fertilized and if the disease occurs among the plants in the field the application of nitrogenous fertilizer is inevitable. This disease occurs both in the shade and in open cultures.

Nematode or root knot.—Root knot is caused by a minute eelworm or nematode, *Caconema radicicola,* which bores into the roots. These little worms, scarcely visible to the naked eye, cause the roots to develop characteristic hypertrophies or galls varying greatly in size. The disease, therefore, is very easily recognized by examining the root system. Plants heavily affected with root galls are stunted in growth and appear chlorotic. Seedlings with root galls should not be planted and fields severely infected should either be fallowed or planted with other crops for at least two or three years before they can be planted again to tobacco.

Bacterial (Granville) and Fusarium wilt.—The causal organism of bacterial wilt is *Bacterium solanacearum* E. F. S. while that of Fusarium wilt is *Fusarium* sp. Both diseases attack the root system of tobacco and other members of the nightshade family like potatoes, tomatoes, eggplants, etc. It is hard to determine the differences between these two diseases if judgment is based only upon external appearances of affected plants because the symptoms are similar. The only way is to examine the roots and stems of a diseased plant. When the stem or root system is halved longitudinally and the section upon being pressed between the fingers oozes out a slimy liquid that is

somewhat putrid in odor then the disease is of bacterial origin. Otherwise the disease is fusarium-caused. Fusarium wilt infection seems to be favored with a rise in temperature, while the bacterial wilt acts more favorably when the weather is moist and cool. While early planting escapes Fusarium wilt infection a great deal at the same time it stands the risk of a bacterial wilt infection if both diseases are present in the same soil. It is a very unfortunate fact that in the Philippines both diseases occur in the principal wrapper tobacco regions. Bacterial wilt is severe in Laguna while Fusarium is serious in the wrapper district of La Union. Crop rotation should be a good practice, the tobacco rotated with legumes after every five to seven years. The development of resistant varieties, while not an immediate remedy, will in the long run be a more stable and effective method of minimizing the ravages of these diseases. It has been found after seven years trial that, under La Union conditions, severe Fusarium wilt infection can be checked very successfully by erecting shelter tents over the plantation. This finding simply correlates the observation of other workers that Fusarium wilt infection increases as the temperature increases and vice versa. It may be stated here that the growing of wrapper tobacco by shading in La Union Province has come about as an expedient remedy against Fusarium wilt because by doing so the disease is not only placed under control but at the same time the resulting crop is more valuable than the ordinary cigar filler which used to be the regular tobacco crop of the province. Fusarium and bacterial wilt diseases attack tobacco plants in all stages. In mild cases one or two leaves show signs of wilting and as the plant becomes exhausted it gradually wilts and dies. Through continuous discarding of undesirable individuals and the preservation of the desirable ones by pure line cultures may one hope to obtain the highest possible degree of uniformity in a field.

The green leaf spot.—The green leaf spot is a very severe malady of wrapper tobacco. It occurs more frequently, however, in shaded plantations although it also frequently occurs in open cultures. The green leaf spot is not visible in the field but manifests itself only when the leaves begin to dry during curing. It can easily be considered as a malady acquired in the barn. Results of earlier investigations on the green leaf spot seem to point out the possibility of a pathogenic organism as the cause of the spotting but later studies along physiological lines reveal that the green leaf spot is more the result of the effect of adverse climatic factors. Moist weather during the

harvest season, too rapid drying during the early stages of curing, and delayed poling or stringing of the harvested leaves thereby leaving them in big piles for a prolonged period cause the appearance of green leaf spot. The principal characteristics of the green leaf spot are the peculiarly deep green color of the leaves and their brittleness. The spots dry much faster than the rest of the leaves. Chemical analysis of the spotted portions shows a high percentage of chlorophyll and starch as compared with that of the unspotted portion of the same leaf. If the spotting is not very severe, it can be eliminated by drying or fermentation but if the spotting is too abundant traces will always remain even after fermentation. Green leaf spot in a wrapper crop weakens the leaves and makes uneven their elasticity and strength thereby rendering the wrapper very inferior in quality. To minimize the appearance of the green leaf spot, if not altogether prevent its incidence, one has to observe strictly the proper rules governing the process of curing.

TOBACCO BREEDING

Detail study of the tobacco flower.—For a better realization of the ease with which tobacco plants are self-fertilized and of the possibility of cross-fertilization, the following study on the structure and arrangement of tobacco flowers from "Tobacco Breeding" by Shamel and Cobey, U. S. Department of Agriculture, Plant Industry Bulletin 96, is hereby given.

The tobacco flowers are arranged upon a branching determinate flower head, which appears when the middle leaves are about half grown and continue to develop and produce new flowers during the rest of the life of the plant. The accompanying sketch of a longitudinal cross section of a tobacco flower shows the parts of the flower and the general way in which pollination takes place. The calyx (A) is the outer green five-parted, floral envelope at the base of the flower which serves to protect the flower bud. The corolla (B) is the delicately colored floral envelope inclosing the reproductive organs of the flower. Its color tends to attract insects, which are the principal agents in cross pollination. Next inside the corolla are the five stamens which are the male reproductive organs of the filament (I) supporting the anther (J) in which the pollen grains (K) are produced. The central organ is the pistil, or female part of the flower. The terminal enlarged portion (G) is the stigma. The pollen grains (K) adhere to the surface of the stigma and ger-

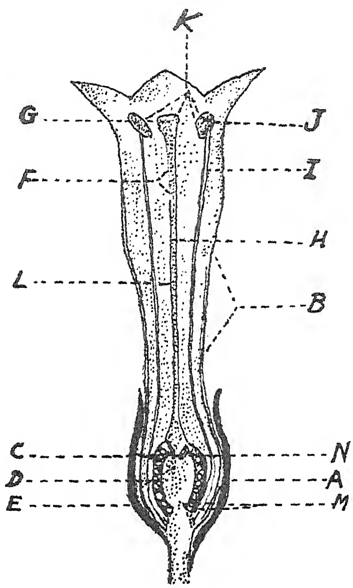

Diagram of a tobacco flower
(Longitudinal Section)

minate, sending an extremely minute tube (E) down through the central conductive tissue (H) of the style (F). This tube extends into the cavity of the ovary (D) and finds its way into the ovule (N) through a small duct or micropyle (M) where fertilization takes place. Other ovules are fertilized by other pollen tubes. These ovules develop into seeds after fertilization. The ovary is two-celled with a fleshy central placenta (C) on which the ovules are borne. The early capsules mature always before flowering ceases. The shape of the delicately colored corolla is somewhat tubular, or, perhaps, more nearly like an elongated funnel. It is comparatively small from the basal end to a point about two-thirds the distance to the terminal end of the flower. At this point it enlarges suddenly to more than twice the size of the basal part of the tube. It is composed of five petals, which coalesce to form the corolla tube and separate only at the extreme end. The tobacco flower is symmetrical. The number of sepals and stamens is always the same as the number of petals, but the floral circles do not remain constant, varying rather indefinitely in different strains and even among individuals of the same strain. Trimerous flowers or flowers with three parts in each flower circle have been found growing in the same plants with pentamerous flowers or those having five floral parts. This is the exception, however, and not the rule.

A very interesting phenomenon occurs in the filaments of the stamens immediately after the opening of the flower. Just before the opening the pistil is longer and extends up beyond the stamens, but when the anthers open and the stigma becomes receptive, a very rapid growth of the filaments takes place, which causes the open pollen sacks to be pushed up past the stigma, and in almost all cases they come in direct contact with

the stigma in passing upward. This gives an opportunity for at least a portion of the pollen grains to adhere to the viscous surface of the stigma for self-fertilization to take place as already described. It is just before this process occurs or while it is in progress that there is danger of, and opportunity for, cross-pollination. The open flower contains a small drop of nectar at the base of the corolla tube which is sought by honey-bees, bumblebees, and humming birds as well as by many species of minute insects, all of which carry pollen from flower to flower and from plant to plant in their constant search for the honey-like substance secreted in the corolla tube. In passing in and out of the flowers the bodies of the bees and other insects and the beaks of the humming birds become dusted with pollen, which is transported by them to the pistil of the next flower visited. The ovules are readily fertilized by pollen from the surrounding plants as by the pollen from the flower in which they are produced. This continuous crossing necessarily results in the introduction and intermixture of poor and undesirable varieties in our best strains of tobacco.

Variation.—For a better understanding of the primary importance of selection in the production of quality tobacco, it should be made plain that under ordinary conditions, tobacco everywhere, while it admits of easy inbreeding, is a variable plant. If one should study the variability of a field of tobacco, he will observe at least the following characters in greater or lesser variation.

1. Height
2. Number of leaves
    (*a*) Number of sand leaves
    (*b*) Number of standard leaves
    (*c*) Number of top leaves
3. Dimensions of leaves and character of petiole
    (*a*) First lowest standard
    (*b*) Last upper standard
4. Form or shape of middle standard
5. Texture
    (*a*) Pubescence
    (*b*) Gumminess
6. Color of leaf
    (*a*) Dark green
    (*b*) Green
    (*c*) Light green
7. Character of leaf surface
    (*a*) Hairy
    (*b*) Smooth or oily
    (*c*) Wavey

8. Position of leaf on stem
    - (*a*) Horizontal
    - (*b*) Erect
    - (*c*) Drooping
9. Length of internodes
10. Branching habits
11. Flowering habits—cluster form
12. Possibly disease resistance

In recording the number of the leaves per plant one or two dead bottom leaves must be discarded. The sand leaves are first counted; they number from 3 to 5. The size of the sand leaves is greater than that of the top leaves.

From the fifth leaf, depending upon the age of the plant, the standard leaves are counted. These are the most valuable leaves and they vary in number. The last standard must not be less than 30 centimeters in length. So all leaves less than 30 centimeters or 11 inches are considered and counted as top leaves.

The dimension of the leaf is determined by measurements of the length and width. The length is measured from the base of the petiole to the tip, depending upon whether the petiole is winged or not. The width is measured at the broadest part of the leaf.

The best way to determine the shape of an average standard is by an accurate sketch or drawing of the leaf. If possible, it is better still to take a photograph.

To determine the texture of the leaves, press the leaf's lamina between the thumb and middle finger. Another way is to use a hand lens. The degree of gumminess is determined by the abundance of gum glands in the form of brownish knobs at the end of the hairs. The hairs occur on both surfaces of the leaves. Heavy rains, however, may reduce gumminess.

Correct sight is necessary in judging the color of the leaf in spite of the fact that it is easy to distinguish green, dark green, or light green. Color, as a rule, determines type because it varies under the same treatment and conditions.

The character of the leaf surface is easy to note. Again the hand lens is very necessary to determine the nature of pubescence, whether coarse or fine. Oily and smooth leaves go together. Some plants have their leaves dry or rough in appearance.

The position of the leaves may be shown by sketches or merely by stating whether they are erect, horizontal, or drooping, with a full understanding of the meaning of each term. The length of the internode is better determined after all the leaves are harvested. Variation in length of internode is determined by measuring the fifteenth internode.

The branching habit is determined by the tendency of certain plants to produce more suckers than others. Flower heads or clusters are judged by their size, uprightness, branching habit, and shape.

In selecting mother plants the important and ideal qualities of the type and variety under study should always be kept in mind. Special attention should be given to the following points: (*a*) size and shape of leaf, (*b*) position of leaf on the stem, (*c*) length of internode, (*d*) density and compactness of flower clusters, and (*e*) color of flowers.

Method of selection.—How to go about saving and caring for the seed of selected parent plants has already been explained. Because tobacco is grown in a heterogenous field, it follows that, although uniform plants may be selected for seed, the progeny from the collectively sown seed may often be quite diverse. There are so many characters involved, some of them invisible or latent, that in the breaking of types in subsequent generations, the extent of variation is hardly reduced. The safest and surest method, therefore, is to grow the inbred seed of each parent plant in the same plot or row. In the second generation considerable variation may still be apparent but beginning with the third generation by discarding all individuals not answering to the ideal type and growing only the seed of those plants identical with or nearest to the ideal, one may well be assured of the uniformity of the fourth generation. Through continuous discarding of undesirable individuals and the preservation of the desirable ones by pure line cultures, the time finally comes when the highest possible degree of uniformity is manifested in a field.

Monstrosities.—Every grower is perhaps aware of so-called monstrosities or teratological occurrences in tobacco fields in the form of pitcher-like leaves, fasciated stems, etc. Various theories, such as environmental, physiological, etc. have been advanced to explain the causes of such occurrences. Because monstrosities have been definitely proven to reoccur frequently from the propagation of self-fertilized seeds of monstrous plants these plants should be discarded.

Records.—Permanent records are essential for a better understanding of the immediate problems of the grower or breeder. Having the figures and data always on hand, one can better appreciate what is wrong with the seed or where improvement has been definitely attained. In selection as well as in hybridization, it is necessary that an accurate description of all plants in pedigree cultures be given with the most painstaking care.

A good method of recording description is by following the list presented in connection with the study of variation. To this list, however, must be added the following:

Yield per acre or hectare.
Quality of cured leaf.
Quality of fermented leaf.

The opinion and the advice of cigar manufacturers or experts should be sought as a guide in determining and improving the last two properties.

Environmental considerations.—While it is an admitted fact that environment may affect the tobacco plant in growth and in composition, it cannot be a medium in the production of new types as claimed by certain writers. Lately sufficient evidence has been presented dispelling all possible faith in this belief. The experiments of Hasselbring and Hayes prove conclusively that crossing is the only means of producing new types.

HYBRIDIZATION, ACCLIMATIZATION, MUTATION AND SEED SEPARATION

An account of the floral structure and seed development of tobacco has already been given. Strictly speaking, hybridization is the crossing of any two plants different from each other in at least one heritable character, whether they are of the same or of different variety or species. Plants are hybridized to increase their variability, thus affording more material on which to practice selection. In order to understand the rôle of hybridization in plant breeding, however, one must be acquainted with some of the underlying principles attending the problem.

In the first place, the parent should produce true-to-type seed after at least two to five seasons of testing, because, as will be later explained in the light of modern Mendelian studies, seed behaving with variability is actually of hybrid origin.

The technique of hybridization of tobacco.—To begin with, it does not make any material difference which variety is used as the male and which as the female parent. The plant to be used as the female parent should be emasculated and prevented from setting seed fertilized by its own pollen; this should be performed before the anthers have matured. The pollen of the male plant should be applied to the stigma of the female plant when this is in a receptive condition. To prevent the intrusion of foreign pollen, the flowers should be bagged in the manner as for self-fertilization or inbreeding.

It appears that in tobacco the later flowers produce larger and healthier seed than the earliest ones; this fact might well be given consideration in hybridization. The best time for emasculation is when the flowers are apparently fully developed but the corollas still closed. In order to insure protection to the pistil, the corolla and the calyx should not be cut off as is the general practice. Artificial pollination is just as conveniently done by merely slitting the corolla at one place and piercing it at two points vertically at the middle with an ordinary pin to keep it well open. With small scissors the anthers are easily removed. Sometimes as a means of precaution, the stigma is washed with a dental syringe before pollinating it. The pollen should be applied with a smooth-surfaced pointed instrument like a scalpel which can be easily washed in order to be sure that only pollen of pure origin is used. Because of the large number of seeds produced in a single pod (from 3,000 to 5,000 seeds), it is not necessary to pollinate a great many flowers. All non-crossed pollinated flowers should be carefully cut out with small slender scissors.

Inheritance in plants.—It has been demonstrated by experiments in sexuality and inheritance in plants that the different plant varieties, although we designate them as such, are not wholly so homogenous and so uniform as "pure lines." When we visit a field of tobacco exhibiting variability in a greater or lesser degree, our common sense would lead us to pick the most desirable individual plants for seed. It has already been made clear, how, by insured inbreeding, we can better expect the preservation of the desirable characteristics.

Modern biologists have given the term "character" to any one of the many details of structure, form, substance, or function, which make up an individual. For example, in tobacco, we speak of the leaf size, leaf grain, branching habit, etc., as characters. The transmission of the characters of parent plants to their progeny depends on free heritable elements known as factors. In the modern science of genetics, which seeks to account for resemblances and differences exhibited among organisms related by descent, factors are expressed in orthographical symbols which are worked out mathematically in much the same manner as chemical symbols, formulae, equations, etc. Examples of this notation will be found in the succeeding paragraphs.

This factorial systematic interpretation of inheritance is based largely upon the experiments of Gregor Mendel, discoverer of

the laws of heredity. Working with garden peas, he conducted investigations on the inheritance of certain definite characters. He began his work by testing varieties of garden peas exhibiting opposite pairs of characters for two or more seasons to be sure that each variety possessed the ability of reproducing itself absolutely true from the seed. Mendel studied at least seven opposing pairs of unit characters, but for the present, by way of an illustration, only one pair will be discussed. He crossed tall and dwarf peas and found that the hybrids or the first (F_1) generation consisted only of tall plants like the tall parent. He called the tall variety the dominant type. In the second (F_2) generation, by selfing the hybrids, he found that these characters split up (segregated) in a more or less uniform and definite ratio–three-fourths of the plants were tall and one-fourth was dwarf. The dwarf was then designated as recessive to the tall. In the subsequent generation (F_3), by selfing the progenies the dwarf plants produced only dwarfs, while one-third of the tall plants bred true and the other two-thirds produced both tall and dwarf plants in the same proportion as the second (F_2) generation. The numerical ratio of 1 :2 : 1 for the F_2 generation may therefore be established.

For the sake of simplification, the factor for tallness may be represented by "T" and the factor for the opposite character, "t". The small "t" is used for the latter because it does not find expression in the hybrid. The numerical values of the hybrids may therefore be algebraically expressed thus: TT/2Tt/tt. The resultant fusion of the gametes of both sexes is known as zygote.

When the fusing or uniting gametes possess the same characters, the resulting zygote is said to be a homozygote and its constitution, homozygous. Pure strains of plants are, therefore, homozygous. According to these definitions, when the dwarf plants are selfed, they produce only dwarf (homozygous) progeny. On the other hand, when the dwarf and tall plants are crossed the hybrids do not produce only tall plants. This is explained by the fact that the uniting gametes are unlike in constitution or character. The resulting zygote from unlike gametes is called heterozygote and theoretically each ovule and pollen grain would contain both the T and t characters, combining in about equal proportions as follows:

Ovules		*Pollen*	
T(T)		T(T)	.... TT/2Tt/tt
t(t)	x	t(t)	

When plants having two pairs of differentiating characters were investigated by Mendel, he found that each pair of characters followed the same rule and that the inheritance of each pair was absolutely independent of the other. He crossed a tall plant with colored flowers. It was a case of dominance again, that of colored over white flowers. In the F_2 generation there were plants with colored flowers and plants with white flowers in the proportion of 3 : 1, likewise tall and dwarf plants. Consequently, the chances of a tall plant having colored flowers were three times as great as its chance of having white flowers. This cross resulted, as a matter of fact, in four kinds of flowers, namely, (1) colored talls, (2) white talls, (3) colored dwarfs and (4) white dwarfs, in the ratio of 9 : 3 : 3 : 1, respectively. As in the case of the monohybrid, this can also be expressed as follows (T standing for tallness; t, for dwarfness; C, for colored; and c, for white flowers:

1 TTCC, Tall colored
2 TtCC, Tall colored
1 TTcc, Tall white
2 TtCC, Tall colored
4 Ttcc, Tall white
2 Ttcc, Tall white
1 ttCC, Dwarf colored
2 ttCc, Dwarf colored
1 ttcc, Dwarf white

If we wish to produce a homozygous tall white, all we have to do is to select plants answering the description of three-sixtenths of all the F_3 generation, namely, TTcc and Ttcc. From previous definition, we know that in order that a plant or strain be homozygous for tall white it must have the formula TTcc. The only thing to do is to grow all tall whites, preferably in head-to-the-row cultures. The rows producing only 100 per cent tall-white plants show the pure strains resulting from the original crossing or hybridization. The Ttcc, while all have white flowers, will split into talls and dwarfs in the ratio of 3 : 1, as already explained.

Mendel further pointed out that the principle may be extended indefinitely. To summarize Mendel's experiments: In crossing individuals, differing in a number of opposite characters (provided the parent plants are pure strains), the first generation shows a redistribution of the various characters, subject to the same rule for each character; and if the constitution of the parent is known, the number of possible forms may be calculated.

Some cases of inheritance are not based on dominance. In fact, various logical explanations have been advanced for all kinds of resulting ratios other than 3 : 1. We shall, however, refer specifically to that type of inheritance in which the characters "blend," that is, the offspring (F_1 hybrid) possesses a character more or less intermediate to those of the parents. This is especially true in the case of size characters. The F_2 generation, however, exhibits so much variability that size inheritance is also expressable by Mendelian notation.

In presenting the foregoing account, the writers merely desire to give to the average tobacco grower the underlying facts about hybridization which are now generally accepted and at the same time honor the memory of the discoverer of the laws of heredity. Indeed, detailed knowledge of heredity in tobacco and, in fact, in all living forms in general, involves vast and complex problems for which even over a long period of time it would be impossible to reach conclusive explanations or solutions. At any rate, the grower's as well as the manufacturer's concern is merely the ultimate product and not the complicated extensive technical and mathematical studies involved.

When hybridization is practiced, the work is started with a definite ideal in mind so that the parent plants selected may possess as many as possible of the qualities sought in the new form. An illustration of this is the attempt of the Connecticut Agricultural Experiment Station to combine the well-shaped (rounded) leaves of the Sumatra variety with the large size and excellent qualities of the Havana. After ten years of constant selection, the efforts of the station were finally crowned with the successful production of the now known Connecticut round tip variety. We say "variety" because it differs from any other known standard variety and it breeds true just as the Sumatra or the Havana types. This point should indeed be noted carefully. A new plant or strain may be produced by hybridization, but it continues to be called a hybrid only so long as it exhibits great variability. As soon as it breeds true, it is no longer known as a hybrid but as a variety. As it may be recalled, this resulting combination of the round tip of the Sumatra and the large size of the Havana has been brought about in much the same way as the tall-white flowered peas resulted from a cross between tall-colored and dwarf-white parents.

In practice, a sufficiently large number of the third (F_3) generation is propagated in pure-line cultures (head-to-the-row) in order to test the possibility of obtaining the desired combinations of characters. While mathematically and by expert work, de-

finite results may be obtainable in the fourth or fifth generations, the vast operations involved sometimes delay results for ten years or more. Ordinary selection methods conducted in limited cultures are therefore resorted to instead.

Utilization of first filial generation hybrids in crop improvement with special reference to tobacco.—Hybrid vigor in plants was first observed about two centuries ago by Kolreuter, but it was only in 1917 that the phenomenon was satisfactorily accounted for as being due to the complementary action of dominant factors and termed heterosis by Jones of the Connecticut Agricultural Experiment Station, U. S. A.

In the United States and in Europe, especially among seed and plant dealers, hybrid vigor has long been utilized but apparently, up to the present time, it is being neglected in the Philippines. The only instances of its application locally are in wrapper tobacco, Manila hemp, corn, and sugarcane. Of course, it is also manifested in some native fruits, but this is not realized.

The utilization of hybrid vigor or heterosis is based chiefly on the established law of heredity to the effect that "when pure races or strains are crossed, the population composing the first filial generation is similar to the parents in uniformity." This is mathematically expressed from the observation that if any particular factors XX and xx are pure or homozygous in the parents, only Xx individuals can be formed in the F_1 generation. This law of heredity therefore satisfies a primary essential in crop-production uniformity.

Because of heterosis the next primary essential in crop production—higher yield—is also obtained. Incidentally other desirable qualities are at least retained if not enhanced.

The utilization of hybrids is generally practicable in the case of plants that are reproduced asexually. Otherwise, it is subject to limitations which are primarily and obviously governed by the facility in making the crossing and the profitableness of the resultant yields of the crosses.

As regards crops, especially annual ones reproduced or propagated only by seeds, the limitations are greater. Aside from those already given, the fact that the operation of crossing must be performed yearly in order to insure the supply of fresh seeds limits the production of F_1 hybrid seeds to a few crops.

In the case of tobacco, a plant ordinarily produces 42 pods with a total of about 90,000 seeds. Since it takes only $\frac{1}{2}$ minute to cross a flower, in about half an hour, therefore, the flowers

of a plant can be crossed. And assuming only 75 per cent viability of the 90,000 seeds, one can grow about 3 hectares of tobacco from the seeds of one plant alone. Leaves produced from F_1 wrapper tobacco hybrids have actually been sold for ₱8 per kilo.

The advantages of F_1 hybrids are: (1) immediate results, (2) increased yield, (3) improved quality, (4) maximum uniformity, (5) higher seed viability, and (6) rapid growth.

Through hybridization followed by selection, it takes from 4 to 20 years to obtain uniformity, and once this is attained, the question of yield cannot be guaranteed to equal even that of the higher yielding parent since homozygosity is synonymous with the absence of heterosis.

It is obvious that the best descendant of a cross cannot exhibit any trait superior to any identical trait of either of its parents.

The real reason why seeds of most annuals purchased from American and European seed dealers produce uniform and vigorous plants the first year and fail to repeat the performance the following year is that they are really F_1 hybrids. Seed dealers in America and Europe thrive well because they possess the secret and the original races of the parents of the desirable F_1 hybrids. The original races are continually inbred and at the same time fresh F_1 hybrids are produced yearly.

ACCLIMATIZATION

It is a well-established fact that some plants are grown to better advantage in some localities than in others. When an effort is made to introduce a foreign valuable plant into a new locality, it does not usually follow that the plant retains the same characteristics in the same degree as it did in its former environment. Differences of soil and climate conditions may be the factors directly responsible for contrary behavior. There are cases, however, where in the course of two to five years of continuous testing the plant will finally thrive normally in its new home. The testing of the plant in a new locality, therefore, for the purpose of introducing it into this locality, is called acclimatization, and the result of the tests may either be negatively or positively economical.

There is no better example of this method of improving wrapper tobacco than the attempt to introduce Cuban and Sumatra varieties into the Connecticut Valley. In spite of all kinds of cultural as well as selection efforts to produce a desirable wrap-

per strain from introduced seed (the famous Sumatra variety), and while the plants to all appearances resembled the genuine or original strain, the quality of the product was always decidedly inferior. Finally all attempts to acclimatize it were abandoned. On the other hand, seed of the Cuban variety with the aid of selection not only thrives favorably in Connecticut but its size, quality, and flavor are even superior. It is now used for growing under artificial shade to the complete exclusion of Sumatra.

MUTATION IN TOBACCO

When a different plant is derived from a parent plant by means of a sudden leap, a result of its seed being grown in separate culture, and when it breeds true, just as the rest of the seed of the parent plant, to the characters which have distinguished it constantly from generation to generation, it is claimed that the new plant is either a new variety or a new species, and it is called a mutant or sport—that is, it is produced by mutation. Because of this assertion, the well-known Stewart Cuban tobacco, which originated from a field of a supposedly pure strain of Cuban tobacco, is called a mutant. The Stewart Cuban produces 72 leaves, acquires considerable height, and flowers late as compared with the normal original Cuban which has a mean of 19.9 leaves only.

While mutants are decidedly dependent upon chance, it is well that the grower or the breeder be always on the lookout for them.

SEED SEPARATION

It has been proven that a plant, however healthy or vigorous it may be, produces a considerable quantity of light seeds, and that these seeds do not produce such healthy plants as the heavy ones.

While various ways may be used to bring about the separation of heavy from light seeds, among which is winnowing, a very convenient apparatus called the tobacco seed separator has been successfully devised by Shamel and Cobey of the U. S. Department of Agriculture. By the improved apparatus a current of air is generated by stepping on the foot bellows. The air passes through the rubber tube and then through the glove valve which regulates the passage of the desired amount of air to accomplish the best separation. The air proceeds through a half-inch wide iron tube and then goes out of the top of a large glass tube carrying with it the undesirable light seeds. A metallic joint

covered with fine wire gauze to prevent the seed from falling into the bellows is located at the base of the one-inch glass tube which is 5 to 6 feet long. By using about an ounce of seed at each operation, a pound of seed may be separated in less than half an hour.

The apparatus is cheap and can be prepared at home with the help of a mechanic. It is now purchasable from hardware or chemical supply houses. Being of common use, it is advisable that a group of growers coöperatively own one well-made apparatus. At one time, every municipal government in the tobacco districts in the Philippines owned one tobacco seed separator for the general use of its citizens. Growers took their seeds to the town hall where the apparatus was always available.

PART III. THE MANUFACTURE OF TOBACCO IN THE PHILIPPINES

The Philippines as an industrial country is still very young, but it is justly proud of its tobacco industry, which is at least one of the oldest, if not the oldest, industries of the country. Its tobacco factories are among the cleanest and most modern.

The importance of the Philippine tobacco industry is not sufficiently appreciated. The way it holds its own in world trade, notwithstanding the fact that tobacco as a plant adapts itself to all ranges of climate and soil, is wonderful. Philippine leaf tobacco and manufactures thereof are exported to at least 40 different countries scattered all over the world. The average internal revenue derived yearly from the industry is nearly nine million pesos (₱9,000,000) or virtually 20 per cent of the total yearly collections in the whole Archipelago. Of the laboring population, 6 per cent are dependent upon the tobacco industry. And while the capital invested in the manufacture of tobacco represents only 10 per cent of the grand total for all manufactured and partly manufactured products of tobacco it really amounts to an average of thirty million pesos (₱30,000,000) annually. According to the Census of the Philippines in 1918, the tobacco manufacturing establishments collectively, while ranking twentieth only in number, occupied first place in the total number of laborers employed and in average monthly wages, and third place in total value of production, total cost of production, and total capital invested.

The position of the Philippines as a tobacco producer in the world today is indeed remarkable, considering the fact that tobacco is not a native of the country and was not even known here until the Spanish Missionaries brought seeds of the plant from Mexico during the latter part of the sixteenth century. Today in spite of keen competition, the Philippines as a tobacco-producing country ranks ninth in the world and fourth in the East. It is highly probable, however, that the Philippines today must either rank seventh or eighth because Austria-Hungary was dismembered after the Great War and Brazil has not enjoyed the same opportunities as the Philippines. In the first place the Philippines enjoys free trade with the wealthiest country today—the United States.

In the preparation of this paper, the authors had two main purposes:

1. To present information on the manufacture of tobacco in the Philippines.

2. To explain its problems not so much from the standpoint of the manufacturer as from that of the producer and others who are anxious to see the industry as a whole on a firmer basis.

The producers will always entertain animosity against the manufacturers and exporters so long as they do not realize the tremendous responsibilities borne by the latter. They need to be brought to realize that the manufacturers are necessarily friendly to them as they are dependent upon them. The manufacturers cannot hope to turn out first-class goods from inferior raw materials. If they fail to get certain indispensable materials locally they are obliged to seek for them elsewhere. For instance, they actually buy nearly one million pesos worth of foreign wrappers and Virginia leaf, because we have as yet failed to produce enough of these locally. On the other hand, the manufacturers must recognize the right of the producers and factory hands to lead a decent life by giving them just rewards for their labor in producing the raw materials and in converting same into a manufactured commercial commodity.

The interest of the Government in the industry is obvious. Any Government wants its industries to flourish. And the Philippine Government is most interested in the tobacco industry in particular because it is the best stabilized and the most remunerative. The publicity service, the inspection service, the extension service, the tobacco experiment stations, and the organization of associations among tobacco growers are the principal activities of the Philippine Government at present in its efforts on behalf of the tobacco industry.

KINDS OF TOBACCO MANUFACTURES

In the order of their importance the tobacco manufactures in the Philippines are cigars, cigarettes, smoking tobacco, and chewing tobacco. To these must be added stripped and other partially manufactured tobacco. Cigarettes take more leaf tobacco than cigars, but the best and finest leaves as a rule are preferred in the manufacture of cigars, and the total yearly value of the cigars manufactured usually exceeds that of cigarettes by about 25 per cent.

Two other important kinds of tobacco manufactures are snuff and pipe or smoking tobacco. The first product being as a rule highly perfumed, its confection belongs to perfume as well as to tobacco manufacture. The second, as its name implies, is smoking tobacco especially adapted for the pipe. The manufacture of either of these products is feasible in the Philippines but at present it is not advisable because new ventures are always risky and furthermore they require different materials.

What makes tobacco manufacture really profitable is the fact that there is virtually no waste. Tobacco scraps and cigar ends are in regular demand for export to at least 11 countries, including the United States and Guam. The real waste, namely, tobacco stems and tobacco powder, are good fertilizers, being rich in potash, the principal element to insure good burn for cigars, cigarettes, and other smoking tobacco. Tobacco waste may be applied as fertilizers either in a fresh or burned condition. The waste is also easily disposed of even locally. There is in fact a big firm in Manila that buys all available tobacco waste for conversion into potash fertilizer. But not all the waste is disposed of in this way by Philippine tobacco manufacturers. It has been found that tobacco stems can be chopped to very fine shreds which, properly blended with the regular cigarette leaf fillers, are also utilized for certain brands and shapes of cigarettes.

Then there is an industry in the United States which has developed from the waste or by-products of tobacco manufacturing establishments. This is no other than the manufacture of the so-called nicotine preparations now widely used in that country as insecticides, particularly for the control of aphids. In order to get some idea of the extent of the use of nicotine preparations in the United States, the following is quoted from Bulletin 242 of the Connecticut Agricultural Experiment Station, entitled "Recent Developments in the Use of Insecticides":

NICOTINE PREPARATIONS

"Though nicotine is a stomach poison if taken in sufficient amounts, it is chiefly employed to kill sucking insects by contact. It is often used in the form of tobacco dust, finely ground, but as tobaccos vary widely in their nicotine content and few manufacturers have attempted to place a uniform product on the market, nicotine is generally purchased as a liquid in the form of nicotine sulphate containing 40 per cent nicotine. There are

several commercial preparations on the market sold under various trade names, "Black Leaf 40" being one of the best known in Connecticut. When diluted at the rate of one teaspoonful per gallon, or one-half pint per barrel, and applied as a spray, it will kill most soft-bodied aphids but this quantity may need to be doubled to kill some other sucking insects. Even in stronger applications it does not injure most kinds of foliage. When used alone it is more effective if common laundry soap, one-half ounce per gallon, or two pounds per barrel, is dissolved and added, but this is unnecessary when used with calcium arsenate or with lime sulphur."

Although of course the manufacture of nicotine preparations properly belongs to the chemical industry, it is interesting nevertheless to realize that the waste of tobacco factories can be so disposed of profitably.

THE LEAF MATERIAL FOR PHILIPPINE TOBACCO MANUFACTURES

The bulk of the leaf tobacco consumed in all tobacco manufacturing establishments in the Philippines is obviously native-grown. But considerable importations are now being made of wrappers from the Dutch East Indies and the United States. Recently, too, considerable genuine Virginia (U. S. A.) leaf tobacco has been used by certain factories in Manila in the manufacture of aromatic cigarettes.

Under our cigar filler type there are two kinds of leaf tobacco raised in the Philippines according to industrial use, to wit: (1) cigar and (2) native style cigarette. The first is light and the second, heavy. The Philippine leaf tobacco of commerce comes principally from the following regions or provinces:

1. Cigar or light	Isabela and Cagayan
2. Cigarette or heavy	Ilocos provinces La Union Pangasinan Nueva Ecija Cebu (Barili)

The utility differentiation of our cigar filler crop just noted herein is not due to varietal characteristics of tobacco but rather to the effect of climatic and soil conditions and to no less an extent cultural methods. On the whole the native tobacco varieties at present grown in the different tobacco regions of the Philippines are virtually identical although they may bear different local names, but the seasonal periods as well as the

methods of culture vary greatly in the different regions. For instance, along the Ilocos coast as well as in Pangasinan, the tobacco plants are generally topped very low and the optimum growing period of the plants occurs during the period of the year of the lowest rainfall, or when it is driest. Consequently the leaves become large and thick.

The subdivision of our cigar filler type into two kinds (cigar and cigarette) is due to the fact that the bulk of the product is utilized correspondingly. Indeed a great deal of the cigar leaf crop of the Cagayan Valley is actually made into cigarettes and likewise a great deal of the cigarette crop of the other provinces or regions is blended into the fillers of some of the cheaper grade of cigars. Both kinds are utilized in the manufacture of smoking tobacco, but only the cigarette kind is utilized wholly in the manufacture of chewing tobacco.

The average yearly consumption of leaf tobacco of the tobacco factories is 10,669,604 kilos. Adding to this amount the 19,133,373 kilos of leaf tobacco exported yearly as compiled by the Division of Statistics of the Department of Agriculture and Commerce during the last three years, the total would amount to 39,010,160 kilos. These figures are encouraging for the Philippine tobacco manufacturers inasmuch as the margin of supply over the yearly demand is nearly 11,000,000 kilos or a little over 33 per cent more than the demand. The situation is very advantageous to the manufacturers, but if it continues to remain so, after 10 years the supply will be more than three times the actual demand at this rate. Indeed it is not surprising, even now, if this situation is what is actually responsible for the prevailing low price of leaf tobacco.

HANDLING THE LEAF TOBACCO STOCK BEFORE USE

According to Regulations No. 17 of the Department of Finance the packing of leaf tobacco shall be in *standard bales* containing 25, 50, 100 or 115 kilos of leaf tobacco; standard cases, 100 or 125 kilos; and standard casks, 100, 125, or 150 kilos.

In the Cagayan Valley at present the leaf tobacco is being bought on poles or sticks or in hands and the packers therefore sometimes do the sorting and the bundling of the crops into *pinongos* or hands. As a rule all sound leaves are made into hands and the rest into *pinongos*. The standard size of the bale is 115 kilos, wrapped with convenient-sized matting of dried banana petioles (Butuhan variety) and tied securely with rattan (bejuco). The bale is made thus: A wooden receptacle, with a

minimum capacity of about 11.5 cubic feet and having four loose sides without a cover, is put under the press, going in on wooden rails. It is then filled with tobacco hands or *pinongos* which have previously been carefully packed to weigh 115 kilos or 2.5 quintals in baskets with the use of a steel-yard balance. The filling of the box must be carefully done so that the leaves shall be uniformly spread and they must be so arranged in the corners that the bale can be turned out with perfectly square corners. A mat is placed on top of the pile, square with another mat spread at the bottom of the box. The wooden cover is finally placed on top and the press is applied until the cover exactly fits the receptacle. When in this condition the sides are removed and the matting at the top and the bottom is pulled together to cover the whole pack and the bale is formed and then bound around three times lengthwise and four or five times crosswise with bejuco or rattan strips. The press is provided with four arms, generally, for four men to operate. After the bale is thus securely bound or tied, the pressure is removed and the package rolled out. The bale is then marked permanently with the name of the province and municipality in which the tobacco was grown; the year in which harvested; the classification of the tobacco; and in case it is subject to inspection, its net weight at the time when presented for inspection. No objection is raised by the Bureau of Internal Revenue if additional private marks are shown, provided same are not false or misleading, as provided for in section 6, Regulations No. 47 of the Department of Finance.

The following abbreviations are authorized by the Bureau of Internal Revenue for markings:

Fine	F.
Colorado	Col.
Second	2nd or 2.ª
Fifth	5th or 5.ª
Coarse	C. or G.
Maduro	Mad.
Third	3rd or 3.ª
Sixth	6th or 6.ª
Claro	Cl.
First	1st or 1.ª
Fourth	4th or 4.ª

A bale of leaf tobacco may therefore be marked thus:

1926–Ilagan, Isabela	C–1st or
1926–Ilagan, Isabela	G–1.ª

Storage facilities.—Inasmuch as virtually all the manufacturers of tobacco are leaf-tobacco dealers also, they invariably operate adequate warehouses exclusively for leaf tobacco. In the same warehouse are stored the materials for eventual use in the factories because it is also an established fact that leaf tobacco must be aged at least two years before it can be utilized particularly in the manufacture of cigars. The present leaf warehouses in Manila vary from the old Spanish type of masonry work to the modern concrete. They are all, however, one-story affairs with perfect ventilation and concrete flooring. This one-story type of go-down is most adaptable in the Philippines, particularly in Manila which is located in the earthquake and typhoon belt. Furthermore, the arrangement dispenses with the use of otherwise expensive and superflous elevators.

Aside from the sanitation standpoint, present conservation methods of leaf tobacco in storage offer room for improvement. Rebaling the stock of leaf tobacco in order to separate musty and beetle-infested hands or *pinongos,* as practiced, is good, but in the majority of cases the tobacco that is retained for factory use is rewrapped with the same matting materials, which easily loosen up, particularly in the case of the Butuhan banana matting. Baling the leaves air-tight may obstruct the entrance of the cigarette beetle into the interior of the bales, but the least loosening of a bale cover is sufficient invitation for the beetle. The storage of costly wrapper leaf tobacco in ice plants has been found to be a very good plan, but evidently the method is too costly, inasmuch as the manufacturers have so far refrained from storing their filler tobacco in this manner. Fortunately, once the leaf tobacco is securely stored in the warehouse, the danger from subsequent infestations by molds is forestalled until the leaves are moistened just previous to their use in the factory. In all conservation practices to be observed with leaf tobacco in storage, therefore, one need only take precautions against the beetles.

Basis for classification.—The Government regulates the classification of leaf tobacco only as regards (1) origin, (2) length of leaf, (3) soundness, and (4) use. In addition however, it defines which grades are standard for export to the United States. The methods of classification by the Government are described in Regulations No. 47 of the Department of Finance.

All who are more or less acquainted with the difficult task of the manufacturers to maintain the quality of their products will

agree that, while the Government classification is satisfactory from the Government standpoint, it is not adequate for the purposes of the manufacturers. In the first place, there is no provision for classification by type, a definition of which is given in a previous paragraph. And while the leaf tobacco crop is never the same in different provinces, it is also undeniable that the crop of a province, even of the same year, varies considerably by municipalities and even by barrios, in all or in certain fundamental characteristics, namely, color, flavor, elasticity, strength, size, aroma, texture, etc.

With regard to the cigar type, it should at first be classified into binders, fillers and cigarettes. The binders as a rule are the thinner leaves which are entire. Fillers are as a rule partly or badly broken but of good aroma. The native-style cigarettes are those that are too heavy and strong for cigar manufacture.

The classification regulation should be revised as to provide for the classification of the wrapper, aromatic cigarette and the miscellaneous types.

The almost numberless grades and sizes into which it is almost necessary to classify leaf tobacco of a single crop are justified by the fact that there are numerous brands and shapes and sizes of cigars and cigarettes manufactured by the different tobacco factories in the Philippines. These, in turn, justify their practice on the ground that they must satisfy the various habits and tastes of their numerous customers.

The manufacture of cigars is indeed the foremost branch of the tobacco manufacturing industry as a whole, consuming around 3,000,000 kilos of leaf tobacco yearly, or a little less than one-half of what is consumed in the manufacture of cigarettes. The best and the finest leaves are always preferred in cigar making. And as a matter of fact the cigar wrappers are the costliest of all tobacco leaves. Philippine cigars give importance to our tobacco export trade; among our tobacco products, cigars lead all others.

In the manufacture of cigars is manifest the natural artistic ability of the Filipinos, inasmuch as God's gift to them in the form of small, slender and delicate fingers, is alone responsible for the uniform roll of the almost numberless cigar shapes and sizes which have made Philippine and particularly "Manila" cigars justly famous. So long as this gift remains with the Filipinos and so long as the leaf material used is produced in what is virtually a perpetual virgin region on account of the

infallible overflow of the famous Cagayan River over a plain surrounded by lofty and protective mountain ranges, so long also will the famous individuality of Manila cigars endure.

The Philippines is fortunate in producing an excellent cigar leaf tobacco material for which intricate treatment with various flavorings, essences, extracts, etc. (to correct defects) is dispensed with. Consequently, in the manufacture of cigar in the Philippines, all the processes involved are quite natural and simple. Nevertheless, only the most diligent and patient manufacturers are successful, because these simple and natural processes require extreme care to the minutest detail. As long as the manufacturer succeeds in preserving the distinguishing features or characteristics of his brands and shapes and sizes, his customers will stick to him, and what is more, will increase. In fact if a cigar manufacturer fails the cause is usually traceable to inability to turn out a uniform product.

THE MANUFACTURE OF CIGARS

First steps.—A cigar manufacturer as a rule begins to prepare his leaf materials to be blended according to his secret formula. Realizing how the materials must come from crops of different years or seasons, different provinces and even barrios, one can readily appreciate the difficulty of his task. Furthermore, one blend does not suffice, especially in the case of a factory with several brands and hundreds of shapes and sizes. Fortunately for the Philippine cigar manufacturer, the question of what fertilizers to apply does not trouble him—as is the case of other countries. As already pointed out, the Philippine cigar tobacco is produced from what is virtually virgin soil. However, he observes with keen interest the variations of the weather during the entire growing season of the tobacco plant every year. Long years of experience are his best guide in determining how to use and how to blend with other leaves the leaf crop of a certain season or year. It is certain that the weather conditions of no two years are ever the same. Speaking in generalities, the leaf tobacco crop of too rainy weather is usually sappy and badly diseased. On the other hand, that of very dry hot weather is very gummy and thick.

Description of materials.—In cigar manufacture there are three distinct forms or products of tobacco used, namely, wrapper (capa), binder (capote), and filler (tripa). The first and the last are specialized products, that is, each is produced especially

for the purpose for which it is intended. The wrapper, as the word indicates, is leaf tobacco grown especially for wrapping cigars. It must therefore be uniform in color and virtually free from blemishes and holes or tears. It must be very elastic so that it can be wrapped smoothly and tightly around the cigar. At present, light colors are in the greater demand, particularly for the export trade. The wrapper should be of the proper size and shape to prevent waste, and lastly, as far as possible, without any definite aroma or flavor which would in any way adversely affect the desirable qualities of the filler. The reason for this is not very apparent but is probably connected with combustion products and the access of air. It is certain that the flavor and aroma of the wrappers are always carefully considered in blending tobacco for high-priced cigars. Although the thin wrapper used at present constitutes only about one-fifteenth to one-twentieth of the cigars by weight, it may have a very marked influence upon its appearance—much more influence apparently on account of being plain to the view than if the same leaf were put inside as part of the filler. There are at present three sources of wrapper materials used in the Philippines, namely, locally produced wrapper, imported Sumatra from the Dutch East Indies, and imported wrappers from Florida, U. S. A. The necessity of importing wrapper tobacco from other countries arose from an abrupt popular demand for light color among foreign customers, particularly the United States. Present indications, though, point to the extreme probability of this kind of material being raised in sufficient quantities through the researches and extension activities of the Bureau of Plant Industry and the initiative of the principal tobacco growing companies. As a matter of fact, even with certain native varieties, considerable native wrapper of light colors is being obtained at present.

Owing to the extremely high prices paid for imported wrapper leaves, a study was made of the effect of wrapping material on the price of the cigars. The result of the investigation on the 9 highest priced cigars that are Sumatra-wrapped and the 9 highest priced cigars that are Isabela (native)-wrapped was that the latter cost ₱33 more per thousand on the average than the former. And of the 18 cigars of different brands, shapes, and sizes, the highest priced is one that is Isabela-wrapped; the lowest priced, the Sumatra-wrapped. Here then is a very clear proof that wrappers the equal of Sumatra, if not better, can be produced right at home. If we consider the whole output of

cigars, we will note that about 2 per cent are Sumatra-wrapped, 10 per cent American-wrapped and the rest, or about 88 per cent, native-wrapped. Filler tobacco is raised to form the main body of the cigar. The leaves must therefore be of good and rich aroma and of agreeable flavor and must burn freely and smoothly with as white an ash as possible. Broken but sound leaves constitute the bulk of the fillers used at present.

Binders are not produced in any particular way but are taken from a crop of either wrapper or filler tobacco. They are so called because they are used to cover or bind the fillers preparatory to final wrapping. They are usually, therefore, leaves that are too heavy for wrappers or they are finer filler leaves. And in case of shortage of these materials any filler leaf that is entire and sound may be used.

Manipulation of leaves preparatory to rolling of cigars.—It is an established fact that the wholesomeness of a cigar depends on the age of the leaf material—the older the material the more wholesome the smoke. As a rule, the heavier the leaves the longer they are aged, but in all cases no leaf (filler) is worked that is less than two years in storage.

The most progressive manufacturer, after opening the leaf-tobacco bales of either wrapper or filler, first subjects the leaves to steam sterilization, using a vacuum machine with a capacity of at least 100 kilos of leaf tobacco during a period of not more than 24 hours. The object is to obliterate every possible form of the cigarette beetle. The leaves are next plunged into a tank of water and all surplus water is drained off for 24 hours, when they are then taken into the stripping department, where they are left on stands for at least two hours to allow the evaporation of any possible surplus water remaining.

The fillers are stripped wholly by hand and this is done by removing the midribs from the base to about three-fourths the entire length of each leaf. This operation is usually performed by women and girls. The stripped leaves are scattered over the whole floor space of an especially provided drying room and, when they are dried to just the right pliability, they are piled into heaps at least 50 to 60 cubic meters, or placed in wooden receptacles of similar size in order to complete their fermentation. (It must be understood that the leaves have previously undergone partial fermentation while piled in the growers' homes and later in the packing warehouses before baling). Under these conditions, the leaves soon heat themselves as the result

of fermentation and are allowed to remain so until heat is no longer generated (a sign of complete fermentation). The process usually lasts about from 60 to 90 days, depending upon the average texture of the leaves piled together, that is, the heavier the leaves the longer they will have to ferment. It is of course necessary to rebuild the pile at least three times during the entire period, each time reversing the position of the leaves, in order to insure uniform fermentation in the whole pile.

Lastly, the fermented filler leaves are roughly sorted into three textures (fine, medium, and coarse), after which they are ready for use. Generally the finer fillers are utilized in the rolling of the highest priced cigars; the medium fillers, for the medium priced; and the coarser fillers, for the cheapest.

The wrappers are supposed to be completely fermented before entering the factory—either by the grower or by the packer, that is, incidentally, while in piles, inasmuch as they require less pressure and time to ferment than the true fillers. Consequently, while wrappers are subjected to the same steam sterilization, wetting and stripping as the fillers, they are not fermented again as a rule. They are, however, reclassified into different sizes, colors, and textures to suit the requirements of the different brands, shapes, and sizes of cigars produced. For this work only trained men who are called *rezagadores* are employed. And because of the very high prices paid for wrappers, particularly those imported from Sumatra, they must be handled with the most extreme care to the extent that the most progressive cigar factories today in Manila even employ sufficient number of stripping and booking (combined) machines in order to insure the proper handling of the leaves and at the same time reduce or eliminate unnecessary and otherwise risky handling. "The machine removes the entire stem from the leaf, cutting the selvage from the edge of the leaf. The leaves are booked in perfect condition, tip matching tip, with the cut edge fluffy and even. Tobacco thus stripped is ready to deliver to the rolling table as soon as the books are removed from the booking drum. Machine-stripped stock is worked faster and with less waste than hand-stripped tobacco."

The rolling of a cigar.—The cigar maker sits at a table that contains a front trough for waste, and on which is placed a rack for holding the cigars he rolls. He also has a portable board of very hard wood to roll the cigars on, a flat knife for cutting them into the desired length and for cutting the wrappers into

the desired shape or form (according to the shape of cigars assigned to him), and a small cup of gum tragacanth with which to paste the ends of tobacco around the tip or head of a Cuban style cigar or along the full length of a Philippine style cigar. At one side of the table is the bunch of fillers; on the other side, the book or pad or wrappers covered with a damp cloth, and in front of the cigar maker is the pad of binders. The cigar worker is now ready to begin work. As a rule, he is assigned only one size and shape of one brand, so that he becomes a real expert in his line in due course of time.

The workman takes a sufficient supply of the fillers, arranges them longitudinally so that the smoke may be drawn freely from end to end and the cigar may burn evenly, binds them with a suitable binder or two (in the case of the higher grades of cigars in order to insure a perfect flow of the draft through the cigar length) and, after consolidating the filler rolled in the binder or binders, winds the real wrapper spirally which has been trimmed to proper form with a flat keen-edged knife, beginning at the thick end, butt or tuck and works it down to the tapering or rounded tip or head, where it is twisted to a fine or blunt point and secured with gum tragacanth, which is sometimes colored the same hue as the tobacco to render it indiscernible. The method of wrapping just described is called Cuban style. A simpler method whereby the wrapper is merely cut into a rectangle and folded around the filler body and pasted along the full length of the cigar is called Philippine style. Some of the lower grades of cigars and cheroots are wrapped in this way.

If necessary the cigar is cut to the required length with the aid of a handy wooden gauge, but this is not often used on account of the proficiency of the cigar makers. As a matter of fact this operation is entirely dispensed with in the case of certain shapes which require the tuck or end of the cigar to be rounded. Each cigar maker is also provided with another wooden gauge with different round holes with which to check the required circumference of the cigar. The cigar maker rolls the cigar to roundness with the same flat knife as a finishing touch and sets it on the rack in front of him. As the number of cigars finished accumulates to 25, 50, or 100, they are turned over to a foreman.

Machinery for the rolling of cigars is never seen in the Philippines, although machines are now extensively used in the

United States. The most up-to-date design of this machinery has so far failed to duplicate the product of expert human hands.

A Filipino cigar maker can roll from 150 to 400 cigars per day, depending upon the size and shape and style of the cigar assigned to him. Men and women are employed as cigar makers in the Philippines.

Final manipulation.—The foremen of the cigar makers deliver the cigars to the man in charge of the sorting room or *escogidas,* where the latter with his assistants spreads them over spacious tables for examination as to their size and workmanship. Needless to say the man in charge of this work must be highly trained and experienced. If there is the slightest variation in appearance and feel of a finished cigar, he discovers it and rejects all imperfect work. The cigars, having been carefully examined and measured with regard to length, thickness, and color, are placed in boxes holding from 10 to 500, pressed a little into the boxes, and then subjected again to steam sterilization in a vacuum chamber in order to kill any possible cigarette beetle in any stage before the cigars leave the factory. Each box is thus treated for 24 hours, after which it is taken into the last drying room, which is provided with convenient racks, and heated with steam that goes through iron pipes all over the room. The cigars remain in this room for at least 24 hours and when they are dry and yet soft enough to handle without breaking they are finally taken into the boxing room where they are packed right away and pressed into their boxes of either the native calantas (*Toona calantas*) or the imported Spanish cedar (*Cedrela odorata*) in certain sizes and are banded with paper rings, wrapped in tin foil or tissue paper; or in the case of bundles, tied with ribbons or collectively wrapped with tin foil or tissue paper also. The boxes are then nailed and sealed at the edges with fancy strips of paper, duly labeled and finally stamped and branded with the color mark. The cigars are then ready for the consumers.

On colors of cigars.—Commercially, the colors of cigars are designated at present as *claro* (very light brown), *colorado claro* (light brown), *colorado* (brown), *colorado maduro* (dark brown) and *maduro* (dark). Formerly when *maduros* were the fad, *oscuro* (black) was also a standard color. The manufacturer, however, in his sorting room, distinguishes as many as 100 different shades of the five standard colors mentioned. The idea

of separating the cigars into as many as 100 color shades is nothing but an ordinary business proposition. Absolute uniformity of the bunch of cigars in the same box as to color is guaranteed thereby and thus the whims of the most critical smoker are satisfied. The only colors marked on cigar boxes, however, are the five known to the average smoker.

On cigar boxes.—Cigars were originally packed in wooden containers but now may be packed also in pasteboard and metal as they are done in the United States. Fortunately for the Philippines, the wooden cigar box is still universally used and should always be used for no other reason than that the woods specially suitable for the purpose possess a certain aroma which blends pleasantly with the natural flavor of tobacco thus even improving the quality of the cigars. The wood universally used for cigar boxes is the Spanish cedar (*Cedrela odorata*) of which the Philippines is an important consumer. It is imported in the form of shooks for no other purpose than the preparation of cigar boxes. But for the fact that we have in the Philippines a native wood of similar properties, we should be importing at least half a million pesos worth of the Spanish cedar annually. The name of this wood is calantas (*Toona calantas*) and is described by E. E. Schneider in Bulletin No. 14 (1916) of the Bureau of Forestry as follows:

A tree up to 150 centimeters in diameter; reported from Ilocos Sur, Cagayan, Isabela, Mountain Province, Nueva Vizcaya, Nueva Ecija, Pangasinan, Zambales, Bataan, Laguna, Tayabas, Camarines, Albay, Sorsogon, Mindoro, Leyte, Cebu, Negros, Zamboanga, Basilan Island, Palawan.

Local names.—Añipla (Batangas); bantinem (Mountain Province, Nueva Vizcaya); danigga (Cagayan, Isabela); danupra (Ilocos Norte); kantigñen (Ilocos Norte, Zamboanga); calantas (Mountain Province, Pangasinan, Bataan, Laguna, Tayabas, Mindoro, Basilan Island, Palawan); lanipga (Camarines, Albay, Sorsogon, Samar, Leyte, Cebu, Negros).

Wood soft, light; specific gravity 0.438 (Foxworthy), 0.406 (Puigdules); sapwood small, pale red, rather sharply marked from heartwood; heartwood light to very dark red, but most frequently of the color of average Spanish cedar; grain generally very straight; texture fine or moderately coarse, smooth; strong and lasting odor exactly like Spanish cedar; seasons well except that thick planks are liable to internal checking if not carefully seasoned; very easy to work. Durability II; heartwood prac-

tically never attacked by insects when seasoned, though living trees are sometimes attacked by borers.

Uses.—The only native wood used in Manila for high-grade cigar boxes.

Supply.—Though widely distributed and well known, calantas is nowhere abundant; the supply in Manila is probably rarely equal to the demand.

Prices.—One hundred and forty pesos to ₱180 per M (thousand).

It is thus clear that there is an opportunity for a lucrative exploitation of a particular wood that is quite widely distributed although not very abundant in the Philippines. In view of the project on reforestation of the Bureau of Forestry, enough seeds and seedlings should be collected and propagated for distribution to large landowners who can afford to devote part of their otherwise surplus and vacant lots to the cultivation of calantas. In fact timber can be easily raised because it is a permanent crop requiring little attention after planting.

On brands.—The brand as applied to cigar and other manufactures of tobacco is the basic trade-mark because it sometimes sells the product, the factory name being completely ignored. The factory name, however, is sometimes identical with the brand name. And as a matter of fact, a factory using several brands has its name on one of the brands. A factory sometimes uses as many as 12 brands. A brand as a rule includes several sizes, shapes and colors.

On sizes and shapes of cigars.—Some factories call different forms of cigars shapes, and others, sizes while as a matter of fact any kind of cigar is really a combination of both, although shape is the more descriptive or explicit term if only one word need be used.

The nomenclature of the numerous shapes of Philippine cigars is very extensive and different factories go to the extent of naming certain shapes after famous men in history, famous places and even after deceased managers and prominent stockholders of the company so that it is almost next to impossible to standardize them. Fortunately, the industry is so old that however numerous the present number of cigar factories now operating in the Philippines (including the most recent ones) they cannot afford to use new names altogether. That is, the old standard shapes must ever be known by their old names—the veteran smoker must ever be supplied with only such well-

known shapes as *Presidentes, Excelentes, Especiales, Conchas, Perlas, Perfectos, Londres, Pig-tails* or *Vegueros, Cortados,* etc.

On the basis of the old standard shapes, it is possible to analyze and incidentally classify the different shapes now on the market. When we do so, we shall observe that after all there are only as many standard shapes as the well-known old names. The description of a shape of cigar may be based only on five points, to wit: (1) general form, (2) the form of the head or tip, (3) the form or cut of the end or tuck, (4) the relative proportion, and (5) relative size.

(1) *General form.*—Under this category, a cigar may be twisted all the way, spatulate, oblong, cylindrical, elliptical, lanceolate or conical.

(2) *Form of the head or tip.*—A cigar may be twisted at the tip (with no paste at all), medium pointed, round pointed or cut flat (tucked).

(3) *Form of the end or tuck.*—It is understood that a cigar is always cut or tucked at the end in order to facilitate the lighting of the cigar but the form varies in different shapes thus: pointed, medium pointed, round pointed or cut flat.

(4) *Relative proportion.*—The relative proportion is based on the degree of slenderness or plumpness of the cigar and may be expressed or based on the percentage index of the diameter to the length of the cigar. For instance, very slender cigars include all those having a diameter index of less than 10 per cent; slender, from 10 per cent to 11.9 per cent; medium, from 12 to 13.9 per cent; plump, from 14 per cent to 15.9 per cent; and very plump, from 16 per cent upwards; that is, the range is 2 per cent.

(5) *Relative size.*—This depends entirely on the length of the cigar. Cigars therefore may be classified according to size thus: very small, all shapes having less than 10 centimeters in length; small, from 10 to 11.9 centimeters; medium, from 12 to 13.9 centimeters; big, from 14 to 16.9 centimeters; and very big, from 17 centimeters upwards; that is, the range is likewise 2 except in the case of "big" which has a range of 3.

On the basis of the descriptions just outlined, it is possible to describe and identify the standard shapes of the Philippine cigars and, as we shall eventually find out, there are actually only 39 in number, whereas a single factory in Manila has actually advertised some 190 shapes.

Some correlation studies.—In order to determine statistically certain important features of cigar manufacture, correlation studies were undertaken as follows:

1. Value of cigars by shape per 1,000 in pesos and their weight per 1,000 in pounds.

2. The weight of cigars by shape per 1,000 in pounds and the standard size of boxes in number of cigars (1=10's, 2=25's, 3=50's, 4=100's, 5=200's, and 6=500's).

3. Value of cigars by shape per 1,000 in pesos and the standard size of boxes in number of cigars (the equivalents are given in (2).)

In connection with the size of the cigar boxes, only the most common ones were considered. Ultra de luxe cigars are packed singly in 1's but they are so rare that they are considered as packed in 10's. Other rare sizes, like 125's, 150's, and 250's are not considered at all.

According to these studies there is no correlation between the value of cigars and the weight of cigars per 1,000. This is interesting as it is revealed thereby that since heavier cigars are not necessarily higher-priced, the higher-priced cigars must be lighter in weight or they must be made of the finer leaves. There is apparent correlation between the weight of the cigars per 1,000 and the size of the box in which they are packed. That is, the heavier cigars are necessarily packed in bigger boxes, just because they are cheaper in price as we have just noted. This is to be expected, because to prepare a small box virtually costs just as much as a big box. Consequently, low-priced cigars must be packed in bigger boxes or at the corresponding lower costs. The other positive correlation obtained was between the value of cigars per 1,000 and the size of the boxes. This should be expected also because the higher-priced cigars must not be packed too compactly, as this detracts from their distinctiveness and fails to show clearly the excellence of their workmanship.

Another interesting finding in these correlation studies is that frequency of distribution gives the mode or the prevailing type with regards to cigar values per 1,000 cigar weights per 1,000 and size of cigar boxes. It is therefore clear that the prevailing type as to cigar values falls within the ₱1—₱49 class. These correlation studies show that the prevailing or most common size of a cigar box is the 50-cigar box (containing 50 cigars). And with regard to weight, the most common

is within the 10–19 pounds class per 1,000 cigars, .01–.19 pound or 4.5–8.6 grams per cigar.

Other statistical studies.—Studies on the general form or shape of 219 different shapes and sizes of Philippine cigars showed the following forms.

Spatulate	9
Oblong	15
Lanceolate	22
Cylindrical	58
Elliptical	86
Twisted	3
Conical	26
Total	219

From the above list it is clear that the prevailing general form or type is elliptical, which is therefore the shape in greatest demand or in fashion, inasmuch as the factories turn out only such products as are popular among their customers. Incidentally with the same number of different shapes and sizes of Philippine cigars, a study was made on the proportion actually wrapped with the imported Sumatra leaf. The result was that only 41 or only 20 per cent was found to be Sumatra-wrapped. As already pointed out, wrappers from the United States are being utilized by Philippine cigar manufacturers. As a rule, however, unless one really makes a particular effort to identify the sizes and shapes of cigars wrapped with American leaf, it is impossible to tell which they are because the cigars so wrapped are not openly advertised to the extent that the wrapper origin or source is included. As a rule, however, the American wrapper is utilized locally for the medium-priced brands, sizes and shapes—mostly of the 10-centavo group or what is known as the popular "Manila" in the States, the nickel Philippine cigar.

Indeed it is impossible to determine exactly the proportion of the three different wrappers (according to origin) being utilized by our manufacturers, namely, the native wrapper, the Sumatra and the American because this is an industrial secret.

The composition of leaf tobacco and the quality of the cigars.—Nicotine is universally known as the active principle of tobacco and, being peculiar to tobacco, it is usually the index of the value of the leaf according to its different uses. Because nicotine is a poisonous substance, the less there is of it in a cigar the more desirable the cigar becomes. Since Havana cigars are

considered as a standard for smoking qualities and because according to Rodriguez-Navaz (1905) they contain only 2 per cent nicotine, this amount must arbitrarily be assumed as the maximum content of a good cigar. But according to an analysis made by the Bureau of Science (1925), a typical Isabela (Philippine) leaf tobacco contains only 1.15 per cent nicotine. Is it possible that the best Philippine cigars are even milder than the standard Havanas? May we not charge to this extreme mildness of our tobacco, the prosperous Philippine cigar trade in the United States at present?

There are of course other substances found in leaf tobacco, but for our present purpose reference need be made only to the conclusions reached by Garner (1907) in connection with their relation to the quality of cigar tobacco thus:

(1) The fire-holding capacity is dependent primarily on the content of potash combined with organic acids. (2) Lime in general does not greatly affect the fire-holding capacity, but is an essential factor in the production of a good ash. (3) Large amounts of magnesia tend to injure the capacity for holding fire. (4) Chlorine injures the burning qualities, but it seldom happens that tobacco constituents in general injure the burning qualities, but the effects are not so marked when all the sulphuric acid are combined with potash. (6) So far as is known none of the organic constituents of tobacco, with the possible exception of the so-called tarry acids and the albuminoids, exert a very important influence on the burning qualities.

In this connection we may also mention the work of Loew (1900) on enzymes in tobacco and of Schmidt (1925) on bacteria as regards the supposedly important rôle of these chemical bodies and microörganisms in the composition and quality of leaf tobacco.

THE MANUFACTURE OF CIGARETTES

The manufacture of cigarettes is the second in importance in the manufacture of tobacco in the Philippines requiring nearly 7,500,000 kilos of leaf tobacco or more than twice the amount used in the manufacture of cigars. Of the manufactured tobacco products, however, they rank but a poor second to cigars in total value and third as an export product.

It is evident that the importance of cigarettes is based almost entirely on local demand or consumption and notwithstanding the considerable output of Philippine cigarettes, importations of foreign cigarettes, mostly from the United States, amounted

to nearly ₱6,000,000 in 1936. Here is indeed the most important problem confronting the Philippine tobacco manufacturing industry; the imports in cigarettes are double those of leaf tobacco in value to which must be added part of the value of the leaf tobacco, because part of it is Virginia leaf which is expressly imported for blending purposes in the manufacture of cigarettes in Manila.

The manufacture of cigarettes in the Philippines offers more opportunities for improvement than that of cigars, because their consumption must increase with the years and because more aromatic cigarettes are not at present produced in sufficient quantities even for the local demand, resulting in their importation. Then, too, there is the fact that any decrease in the consumption of cigars is always effected invariably at the expense of cigars. The reason for this is obvious. Cigarettes are cheaper, convenient for busy men, and always sold in quantities.

Materials used in cigarette manufacture.—Unlike the cigar, the native-style cigarette requires only two distinct materials: the filler and the wrapper, and because one is distinct from the other as to source, they can also be designated as tobacco and "paper," respectively. The leaf tobacco material is mostly Philippine grown and as already stated it is produced on the Ilocano coast, in Pangasinan, Nueva Ecija, Cebu, and La Union Province. Quintas (fifth class), Cuartas (fourth class) and spotted Cuarta Superior from the Cagayan Valley are usually utilized in the manufacture of cigarettes. Owing to the steady growth of the local demand for aromatic cigarettes, however, considerable Virginia (U. S. A.) leaf tobacco is now being imported in an attempt by local manufacturers to supply customers with cheaper products. At present, Philippine-made aromatic cigarettes are entirely made of Virginia leaf and there are indications that even Turkish leaf will be eventually used also. Aromatic cigarettes, however, are as a rule very expensive. Consequently, only students and those who belong to the moneyed class really indulge in them. The laboring class will always stick to the cheap natural flavored cigarettes of native leaf.

The term "paper" as applied to cigarette manufacture is very distinct from "paper" as used for other purposes. The cigarette paper is almost pure cellulose, harmless, and free burning. And while as a rule it is devoid of flavor and odor, it is sometimes treated with licorice (regaliz) and certain pectorals. Indeed

the manufacture of cigarette paper is so complicated and so different from that of ordinary paper that it is an industry by itself. And to obtain an idea of this fact we will quote the results of the studies of Doctor Straub on the analysis and composition of cigarette papers by Jordan as published in Tobacco (New York, U. S. A.), Vol. LXXXVII, No. 26, 1926;

"In many cigarette papers basic magnesium carbonate is present, either as an impurity or as an addition to the filler. It will vary in amounts from the slightest traces to about 80 per cent of the total filler and its effect is to regulate the capacity and tightness of the sheet. It has heretofore been supposed that the addition of this compound would increase combustion, but later results have shown that wherever it is present in appreciable quantities the combustion is decreased. Of course, small quantities up to 10 per cent of the total filler will have very little retarding effect, but when this limit is overstepped it is readily apparent from all tests that combustibility is retarded in proportion to the amount present. This may be noticed particularly in papers showing a high percentage of basic magnesium carbonate in the filler, for the ash begins to flake and the general white appearance begins to change to a gray. If a very large percentage is present the paper will not burn, but leaves a black shell around the tobacco and eventually goes out.

"The papers high in magnesia content were all poor burners, due to the fact that two compounds found in commercial alba, or basic carbonate, are soluble in water at ordinary temperature to the extent of 0.1518 gram and 0.04 gram per 100 cc., respectively. When this solubility is compared with that of precipitated chalk (calcium carbonate), which is 0.0013 gram in each 100 cc., it will be seen that where the chalk is used very little material goes into solution, but where the magnesia is used more than forty times this amount is dissolved in the water. But, if we will remember that the wet mat of paper, after passing over the suction box is dried out on hot rolls, it will be apparent that all magnesia in solution will crystallize out in the fiber and thereby cause a sort of fireproofing. This is acting exactly contrary to a filler, for the primary function of that material is to close the open sheet mechanically and give a more opaque appearance, and unless too much filler is used the burning qualities will not be materially affected.

"It must be remembered that the air content of a paper is of primary importance, and next is porosity, which must be of

such a nature that air may find its way to the combustion surface, for with the exclusion of oxygen we have no combustion, and no paper carries enough oxygen unless it has been soaked in some solution similar to the nitrate, which is not in favor with cigarette manufacturers.

"The composition of cigarette papers appears to be: Linen fiber slightly sized with starch or dextrin and filled with the carbonates of magnesium and calcium. The filler in three averaged 24.05 per cent, while two showed an average of 9.13 per cent. The fillers were calculated to the carbonates, while it is possible that a portion of the magnesium was added as peroxide or oxide for accelerating the burning of the paper. This change would not affect the resulting weights appreciably.

"Nothing injurious was found in the ash, filler or pulp. The paper burns to a clean white ash which shows good combustion and the absence of compounds formed by destructive distillation. The filler is not materially changed when the paper is burned, so it has no effect except to promote combustion and to make the papers "tight." No test was found for alkaloids or alkaloidal salts. No poisonous metals were found (absence of hydrogen sulfide precipitate). No bad effect was had from the small amount of sizing, as is evidenced by the good burning qualities and the absence of compounds formed by destructive distillation."

"Tests for the heavy metals, with special tests for arsenic were carried out, using a sample from each paper, but not a trace of heavy metals was found, and the Marsh test for arsenic failed to reveal its presence. Alkaloids and alkaloidal salts were never found, although many reports have been circulated to the contrary. A microscopic examination showed linen fiber. However, small amounts of other fiber might have been present but had not been detected. This is due to the fact that very long heating is resorted to before the fiber is in the proper condition and the character of most of the fiber is entirely destroyed. No fiber other than linen has ever been identified.

"Tests for starch and dextrin were had, but the quantity was small. It is probable that dextrin was used as a 'sizing' but hardly probable that starch was ever used. The alkaline condition of some of the fillers would make it practically impossible to use starch. No other sizing materials were ever detected."

The Philippines imports cigarette paper valued at more than half a million pesos yearly mostly from France, Japan, and Spain. The Philippines is not yet an industrial country and

cannot hope for a long time yet to produce or manufacture its own cigarette paper, although according to certain authorities, rice straw and coconut fiber are being utilized for the purpose to some extent. Both of these materials are abundant in the Philippines.

Unlike cigar manufacture, the methods of which may be considered conservative, cigarette manufacture is very modernized. It requires considerable machinery and more complicated blending and flavoring.

Preliminary operations.—In the case of the naturally flavored cigarettes, the leaf from a newly opened bale is given virtually the same treatment and handling as for cigars. It is at first soaked in water also and then allowed to dry for 24 hours, after which it is shredded (long cut) with a cutting machine. It is next put into a steam dryer for at least 12 hours, after which it is piled up for about a week before it is ready for use. Philippine leaf tobacco utilized in cigarette manufacture may also be blended or not. There are cigarettes made entirely of Isabela leaf, others of La Union, and still others of combinations of Isabela and La Union, etc.

In the case of the highly flavored cigarettes, the preliminary operations are more complicated. Except experimentally, however, nothing has ever been done in the Philippines to treat leaf tobacco for cigarettes in order to render them artificially flavored or highly aromatic. Leaño (1919) with the coöperation of Mr. Olsen found that a combination of 50 per cent Judy's Pride leaves (first grade), 15 per cent Judy's Pride (second grade), 15 per cent White Burley, 10 per cent Warne, 5 per cent Orinoco, and 5 per cent Adcock varieties, produced a mild effect that almost equalled that of the imported blended cigarettes. The fact that the leaves used were all grown in the Philippines from seeds of the varieties referred to is very significant. Notwithstanding the obvious success attained from the experiment, unfortunately it was not repeated.

The data just furnished are only a meagre illustration of intricacies in the manufacture of very aromatic cigarettes. The principles involved can be imagined from the following directions furnished by Mr. Olsen (1919):

1. The tobacco leaves should be thoroughly aged.

2. When the leaves are ready, prepare a solution of sugar, glycerine and water according to the following formula: 2 pounds sugar; 2 pounds glycerine dissolved in 1 gallon of hot water for every 100 pounds of tobacco.

3. Dip the leaves in the solution.
4. Spread the leaves in the air to dry.
5. Shred the tobacco.
6. With the great number of possible combinations with the different number of grades or type of tobacco on hand, it is suggested that the *hit or miss* method of finding the combination be made.
7. Perform actual test by smoking each combination.
8. The one which suits the taste of the smoker is the right combination.

It is further evident from these directions that the operations not only involve complicated blending but also the judicious use of flavoring ingredients.

The making of cigarettes.—Native-style Philippine cigarettes are either handmade or machine-made. While in other countries manufacturing cigarettes, machine-made cigarettes have almost supplanted those handmade, in the Philippines, the latter are still abundant. The fact is that on the whole, the cigarettes made by hand are after all daintier and more substantial. This is especially so with respect to the characteristic Philippine naturally flavored cigarettes. Of the different shapes and sizes of cigarettes manufactured by one of the biggest tobacco factories in Manila, 11 are handmade and only 7 machine-made. The deft fingers of a single girl can turn out as many as from 2,000 to 3,000 neatly and uniformly prepared cigarettes per working day, depending upon the size of the cigarettes and whether they are with or without a mouthpiece. The process of making cigarettes by hand is like that for cigars, except that the filler is shredded and the wrapper is paper. Paste of the finest quality is used for fastening the edges of the wrappers.

The machine for making cigarettes is a wonderful piece of mechanism, and is easy to operate. The cigarette machines used in the Philippines are of different kinds, mostly of American and French make. A cigarette machine is fed with shredded tobacco or tobacco cut into flakes, converting the material into perfect cigarettes at the rate of 100,000 every 10 hours. The material is first taken up by drums and rollers and combed by the machine. It is next conveyed through pin rollers to a metal hopper from which it proceeds evenly to a thin strip of paper and is rolled to form cigarettes. Cigarette paper comes in special rolls, is moved by rubber wheels and is stamped or otherwise marked as it leaves the rolls to receive the tobacco. At first the cigarette is in the form of a long roll with the edges

of the paper thinly pasted or dumped; before it leaves the machine, it is cut by a very fast revolving knife into the desired lengths or according to the size of the particular brand of cigarette being turned out. The cigarette machine has special adaptations also. It can be adjusted to conform to a desired "size." It can treat the rolled cigarette with a cohesive substance for gold, cork, and otherwise insure the tipping of one end. It can also be made to close one end of the cigarette as in the case of the Spanish or tuck-in kind.

On brands, names, and prices of cigarettes.—There are no common names with respect to similar shapes or sizes turned out by the different manufacturers in the Philippines as for cigars. The descriptive terms with respect to the lengths (relative) and strength or mildness of the flavor of the cigarettes, including the form of the cutting of the fillers, are standardized as follows: With respect to length, a cigarette may be *corto* (about 75 millimeters), *entrelargo* (about 90 millimeters) or *largo* (about 110 millimeters). With respect to mildness, a cigarette may be *fuerte* (strong), *entre-fuerte* (midway between strong and mild) or *suave* (mild). The fillers may either be *hebra* (long cut or shredded) or *cuadrillo* (square cut or flake-like).

The prices of Philippine cigarettes are based on whether they are plain-tipped handmade, plain-tipped machine-made or tipped handmade and machine-made. The average price of 23 kinds of plain-tipped handmade cigarettes was found to be ₱6.40 per 1,000; of 25 plain-tipped (closed and open), ₱2.80 per 1,000; and 7 de luxe (tipped), ₱13 per 1,000.

Packing.—The packing of cigarettes in the Philippines is still mostly done by hand although some cigarette packing machines are being used. This is a real tribute to the deftness of the Filipino women workers in our cigarette factories. who do all this work. Their small sensitive fingers can pick cigarettes up in groups of tens, twenties or thirties very rapidly and accurately. De luxe cigarettes are either packed in wooden boxes with a capacity of 100 or 200 cigarettes, or in fancy cardboard packages holding 10, 15 or 20 cigarettes. All other cigarettes are packed in glazed paper packets holding 20, 24, or 25, and 30 cigarettes and sometimes covered with tissue paper at the open end.

Additional notes on the manufacture of highly aromatic cigarettes.—This subject certainly deserves some special remarks in view of the tremendous growth of the importation of not

only finished aromatic cigarettes from the United States but also of raw Virginia leaf for no other purpose than the manufacture of the same cigarettes in the Philippines. The attempt on the part of certain Philippine manufacturers to make aromatic cigarettes from imported Virginia leaf must have been found profitable, because there is evidence of the expansion of the venture to the extent that a certain factory in Manila is on the way to even utilizing Turkish leaf, which is the costliest of all raw materials for cigarettes. Mention has already been made of a successful experiment conducted locally on the possibilities of using acclimatized varieties that are especially adapted to the manufacture of aromatic cigarettes if judiciously blended.

Of special interest, in this connection, are the results of the analysis of five famous American cigarettes, most of which are in popular demand in the Philippines, as given by Bailey and Andrew (1922) of the Connecticut Agricultural Experiment Station, U. S. A., as follows:

Brand	Loss at 100 °C.	Ash	Nitrogen	Nicotine
	Per cent	*Per cent*	*Per cent*	*Per cent*
Lucky Strike	7.63	16.54	2.23	1.83
Melachrino	7.34	17.74	2.58	1.43
Camel	7.98	15.30	2.24	1.80
Fatima	8.25	13.63	1.99	1.72
Murad	7.33	17.14	2.72	1.46

It is thus clear that even among the best kinds of cigarettes low nicotine content is essential. It should be even a little lower than in cigars. It has already been pointed out that in Isabela Province, leaf tobacco of remarkably low nicotine content is being grown.

Because in the United States the manufacture of cigarettes is done by machinery almost entirely from the time the bales of leaf tobacco are opened until the finished product leaves the factory, because practically all the cigarettes imported into the Philippines come from the United States, and because of the efforts of certain local manufacturers to manufacture cigarettes similar to the American imported product, it may not be amiss to quote here a brief description of an up-to-date American cigarette factory showing the numerous kinds of machinery used and the functions of the different machines, which appeared in Tobacco, Vol. LXXX, No. 23, 1925.

"In the manufacture of cigarettes, the handling of the leaf in preparation for cigarettes is determined by the grade of tobacco used. Tobacco with small stems is usually handled without stripping. The heavy or butt end is cut off in a "butt cutter" (1) and the leaf is fed to a machine in which it becomes softened or pliable for use. This machine is called "ordering" or "steaming" (2).

"In some factories the butt ends are passed through a "steam-flattening" machine (3) and mixed with the leaf.

"Tobacco leaves which have plenty of stems (heavy) or fiber are first passed through the ordering and softened, after which the stem is removed by hand or automatic machinery (4) before the flavoring is applied. Tobacco leaves containing a large amount of sand or dirt are first passed through a special screen (5) for cleaning before being fed to the ordering machine. This equipment is also used for mixing or blending; the required quantities of the various grades of tobacco are fed to the machine, and in passing through they are properly mixed and blended.

"From the ordering machine the tobacco is fed to a "casing" or "flavoring" machine (6), in which the proper amount of flavoring is applied to the leaf. For cooking and preparing the flavoring, a machine known as "dissolver" (7) is commonly used.

"At the discharge end of what is known as the casing machine, the tobacco is passed over a magnetic chute (8), where the metallic substances, such as nails, etc. are separated from the tobacco. The cased or flavored tobacco is then placed in storage bins for a period of approximately 24 hours, to enable the flavoring to become absorbed by the leaf.

"The next operation is to take the tobacco from the storage bins and pass it through an ordering machine, in which it is properly softened and prepared for feeding to the tobacco "cutting" machines (9). A magnetic chute can be applied to the discharge end of this ordering machine to remove any metallic substances which still remain in the tobacco.

"The cutting machine for cigarette tobacco must be of rugged construction and accurate cutting, as the quality of the cigarette depends on a regular cut tobacco. When cutting tobacco for fine grade cigarettes, the cutting knife must be changed every 10 minutes or less, and an "automatic knife grinding" (10) is required to keep a sufficient quantity of knives ground for the cutting machines.

"From the cutting machines the cut tobacco is transported by an "automatic conveyor apron" (11) to the "rotary steam dryer" (12). This dryer removes the excess moisture which has been applied to the tobacco during its preparation for cutting.

"From the steam dryer the tobacco is automatically conducted to a "cooling" machine (13) which removes the excess of heat from the tobacco and also any dust or sand. The finished cut tobacco is then placed in storage bins for a period of approximately 24 hours to become equalized in moisture content.

"Before the tobacco is fed to the cigarette machine (14), it is passed through a machine known as a "dressing" machine (15) which loosens the tobacco up and puts it in proper order for use in the cigarette machine.

"To remove any metallic substance which may be contained in this tobacco a magnetic chute is attached to the discharge end of the dressing machine. The tobacco is then fed to the cigarette machine and manufactured into cigarettes.

"A certain percentage of these cigarettes is defective and these are broken up in a machine known as a "cigarette ripper" (16). These broken cigarettes are then placed on a special separating sieve (17) which removes the paper from the tobacco. This tobacco is then returned to the storage bins, or is used again in the cigarette machine.

"Finally, the finished cigarettes are taken to automatic machines (18) for packing from which machines they are sent to the shipping department for distribution."

It will be noted that there are at least 18 different machines and appliances utilized in an ultramodern American cigarette factory. But these are not really all that are actually used, for many American factories even operate their own printing plants. And even the affixing of the internal-revenue stamps is being done by machines.

The John B. Adt Co. of Baltimore, Maryland, has prepared a very "interesting flow sheet showing the arrangement of the various machines in a modern cigarette factory designed for an output capacity of 10,000,000 cigarettes every eight hours." But if any Philippine manufacturer should want to build a modern cigarette factory along the plan just outlined, he would need to add only a few more machines, as most of the machines indicated are actually in operation in the Philippines.

THE MANUFACTURE OF SMOKING AND CHEWING TOBACCO

The manufacture of smoking and chewing tobacco in the Philippines is also important though far less so than the making of cigars and cigarettes. The manufacture of smoking tobacco utilizes more than 400,000 kilos of leaf tobacco yearly, the production being valued at from ₱200,000 to ₱300,000 yearly, while for chewing tobacco more than 200,000 kilos of leaf tobacco are used yearly, the production being valued at practically the same amount as that for smoking tobacco which is wholly the product of machinery, whereas chewing tobacco is rolled by hand like cigars. The average yearly importations of more than ₱700,000 worth of chewing tobacco, practically all from the United States, and nearly ₱150,000 worth of smoking tobacco, mostly from the United States and China, may be considered as a sign that there is also sufficient ground for improvement locally of these two tobacco products. Greater production of chewing and smoking tobacco in the Philippines would diminish the tendency to oversupply the raw material. The Philippines consumes all its chewing tobacco product and exports only about ₱20,000 worth of smoking tobacco annually. It is true that the considerable importations of these two products may be accounted for by the presence of the United States Army in the Philippines, but a great many Filipinos have also already learned to use them. And as a matter of fact American smoking and chewing tobaccos are now being sold in many small communities where there are no Americans.

The manufacture of smoking tobacco.—At present the Philippines manufactures only natural flavored smoking or cut tobacco. The leaf material used and the method of preparation are the same as for cut or shredded tobacco for the fillers of the cigarettes. Tobacco is likewise cut into either "long" (*hebra*), shreds or in squares (*cuadrillo*). Philippine smoking tobacco is packed in paper packages holding 100, 125, 250, 450 and 500 grams. The form of the cut does not affect the price, which ranges from ₱0.25 to ₱1.40 per packet of 500 grams. As with cigarettes, it is the quality of the tobacco that influences the price. There are no specific names used to designate brands, but the contents of a packet of smoking tobacco may be designated as *fuerte* (strong) *or entre-fuerte* (medium) as in cig-

arettes, or as *extra superior* (best quality), *superior* (fine quality) or *corriente* (ordinary).

Inasmuch as some of our manufacturers are beginning to manufacture very highly aromatic cigarettes similar to the imported American product, and apparently are meeting with success in their endeavor, there is no reason why the manufacture of aromatic smoking tobacco similar also to the imported should not be tried. It would not mean any additional equipment or machinery unless granulated smoking tobacco were also to be manufactured. But there is no need to manufacture this kind of tobacco at present. Too few Filipinos use pipes.

The manufacture of chewing tobacco.—The chewing tobacco manufactured in the Philippines is called *mascada*. As a rule, the darkest, coarsest and strongest leaves are exclusively used for the local manufacture of *mascadas*. They are prepared in almost the same manner as cigars, particularly those so-called Philippine style cigars. That is, the wrappers are cut into rectangular shapes and wound tightly over bunches of fillers, dispensing entirely with the use of binders. They are uniformly 10 centimeters in length, are pressed into bundles of 6, 12, and 20 and then they are ready for sale. Absolutely no artificial treatment is applied to the manufacture of Philippine *mascadas*. Native chewing tobacco is sold at from ₱1.20 to ₱2.40 per kilo. Filipinos use it either alone or mixed with *buyo*.

In 1919, Mr. Olsen of the big Olsen Syndicate issued a statement that "with the necessary accessories we can manufacture plug (chewing) tobacco in the Philippines to supply the local demand." As a matter of fact Leaño (1919) with the coöperation of the same Mr. Olsen pointed out the possibilities of utilizing the leaves of certain acclimatized American tobacco varieties for the manufacture of chewing tobacco similar to the imported product. To attempt to manufacture chewing and plug tobacco, however, on a large scale in the Philippines, would require a special machinery also. For the benefit of those interested in the modern manufacture of chewing and plug tobacco, the following description of an up-to-date factory as described by Killbrew (1920) is given:

"In a properly constructed tobacco factory, the first work begins in the upper story, to which the hogsheads are elevated. The work begins in the leaf department. The casks are taken off, so as to expose the tobacco. It is taken, bundle by bundle, and shaken. The inferior tobacco is thrown in one pile, and

the better qualities assorted and put in other piles. Water is sprinkled over each layer of bundles as they are put in the piles, and the tobacco remains in this condition for 24 hours, so that the moisture may become evenly distributed. Women mainly, and sometimes men, are employed in untying the bundles, and picking, leaf by leaf, assorting and separating them into the different qualities suitable for the various brands to be made in the factory. The leaves are then brought into a high state of moisture by steam, and the midribs or stems removed. After this, the strips or stemless are passed by chutes, to the next floor below, which is called the wrapper room, where the sauces and other flavorings are applied by dipping the leaves in a vat filled with the flavoring liquids. These sauces are compounded and cooked in immense kettles arranged for the purpose, and their density is determined by hydrometers, so as to keep them true to the formula adopted. These formulas are usually one of the secrets of the manufacturer, and upon the popularity of the flavor used depend, in a great degree, the profits of the business. The sweetened and cooked liquid is poured into immense vats. After the leaves have been thoroughly saturated with the liquid, they are made to pass through wringers, so as to press out the surplus liquid, which flows back into the vat. The leaves are then passed over a series of heated rollers, becoming thoroughly dry, but are again reordered by steam and packed in bulk, to remain until wanted for making into plug.

"The next step is to pass the mass of sweetened leaves, by a chute, to the floor below, or lump room, where it is weighed, enough at a time to make a plug, and this quantity is put in a shaper, which gives the desired form and size to the plugs. These pressed plugs are passed to benches or stands where the wrappers are put on by skillful men. These wrappers are carefully selected as to color and character of leaf, so that the same general appearance may be given to the plugs of the same class. All plugs deficient in weight or defective in color are rejected. The perfect plugs are now dried and packed in boxes for the floor below where they are put in iron cases and pressed and creased.

"The different brands require different hydraulic pressure. Shape mills and pot mills are used. While the plugs are under pressure, they are put in gums and allowed to sweat or ferment. Some brands are fermented lightly, others undergo a long pro-

cess of fermentation. In each case, the purpose is to adapt it to the market for which it is intended and where it is in demand.

"After this fermenting process, the plugs are taken out again and carefully inspected, the faulty ones being rejected and the perfect ones tagged and packed in boxes. When the boxes are filled only enough pressure is put on to get in the heads. When these are fastened in the boxes, they are sent to the shipping room, where they are branded with name, size of the plug, and the gross and net weights of each box. There is a groove on each box for the government stamp, which must be placed on each package, and then varnished and cancelled. The boxes are strapped in packages of five or more, for shipment."

PARTIALLY MANUFACTURED PRODUCTS OF TOBACCO

Philippine partially manufactured products of tobacco are stemmed leaf, long filler, short filler, cigar cuttings, and scrap tobacco. They are defined in section 11 of Regulation No. 47 of the Department of Finance (1925) as follows:

Stemmed leaf applies to clean, stemmed, unbroken leaf free from mold or must.

Long filler applies to clean, long pieces of broken leaf, free from stems, waste, and cigar cuttings, suitable for use as filler without further preparation, and free from mold or must.

Short filler applies to clean short pieces of broken leaf, free from stems, waste, and cigar cuttings, suitable for use as filler without further preparation, and free from mold or must. Only pieces of tobacco which will not pass through a screen of 2 centimeters mesh will be considered short filler.

Cigar cuttings applies to clean cuttings or clippings from cigars, unmixed with any other form of tobacco.

Scrap tobacco applies to all classes of partially manufactured tobacco not included in any of the above terms.

The first three are really filler tobacco, stripped locally before being exported either to save freight or shipping space or because the cost of stripping is appreciably lower in the Philippines than in the importing country as in the case of the United States. The reason why short fillers, cigar cuttings, and scrap tobacco are exported is that some countries manufacture cigars with short fillers or with a combination of short and long fillers. The importing countries, however, use Philippine leaf tobacco only for blending purposes.

The Philippines exports all the cigar cuttings, scrap tobacco, and short filler, which, combined with the stemmed leaf and long filler, form a considerable item in the total Philippine export of tobacco products, amounting to nearly half a million pesos yearly. A very significant aspect of this item is that the Philippines only exports it without importing any similar product or products.

SUPPLEMENTARY NOTES ON IMPORTANT INDUSTRIES DEPENDENT UPON TOBACCO MANUFACTURE

As to the machinery (mostly for cigarettes), cigarette paper, cigar boxes and lithographs and similar prints, labels, flaps, bands and wrappers (as tissue paper, tin foil, etc.) used in the industry, the first two will always have to be imported because they are not only patented but also because the materials used are neither mined nor produced in sufficient quantities locally. Most of the tobacco machinery used in the Philippines come from the United States, France and Great Britain, while cigarette paper, as already pointed out, comes mostly from France, Japan and Spain. As to the third item, the Philippines imports about ₱100,000 in value yearly. In Manila there are several up-to-date lithographic plants that turn out excellent work as can be seen by the cigar boxes decorated with lithographs printed locally. The Philippines also imports cigar box shooks valued at about the same as the imported lithographs, etc. yearly although this country is an important exporter of lumber.

INSECT PESTS AND SAPROPHYTIC FUNGI ATTACKING AND DAMAGING STORED AND MANUFACTURED PRODUCTS OF TOBACCO

Insect pests.—Stored tobacco, cigars, and cigarettes are frequently attacked by insects, of which the most important is a small beetle of the family *Ptinidae* [*Lasioderma testaceum* Dufts or *L. serricorne* Fbr.]. This beetle breeds in tobacco and many other vegetable products. The adults bore their way out, leaving small round holes. This of course ruins the cigars and cigarettes, or if leaf is attacked, it is spoiled for wrapping purposes.

Because of the destructibility of the cigarette beetle, considerable research work has been undertaken in almost every country where tobacco is handled, to find an effective means for its

control. The best paper on the subject has been prepared by Runner (1919) and may be summarized as follows:

In tobacco factories, the principal sources of infestation of the finished products are:

1. Infested leaf tobacco brought into the factory.

2. Tobacco warehouses, where beetles are present in large numbers, close to the factory.

3. Infested tobacco, refuse material, cigars or manufactured tobacco which has accumulated. (Beetles breeding from this material quickly spread to all parts of the factory.)

A very few beetles present in storage or packing rooms in factories may be the cause of serious loss by depositing their eggs on the finished product. The protection of the product at this time is usually of more importance than the condition of the raw material, since the leaf tobacco in most cases is partly or completely freed from different stages of the beetle by handling or by the process of manufacture. Whenever possible manufactured tobacco should be packed in insect-proof containers.

The more important means of controlling the tobacco beetle may be summarized briefly as follows:

1. Scrupulous cleanliness in the factory, wholesale or retail establishment, including prompt destruction or treatment of all refuse material.

2. In factories, screening or otherwise protecting the finished product from infestation.

3. Constructing or refitting packing or storage rooms, especially in warm localities, so that they can be quickly and easily cleaned, and with a view to the exclusion of beetles which may be present in other parts of the factory.

Among destructive agencies which may be employed in the control of the insect are:

1. Freezing. (Treatment by cold storage) or

2. High temperature or steam. (A temperature of from 125° to 140° F. continued for several hours, or 150°F. for a short time, kills the beetles in all stages.)

3. Trapping or destruction by mechanical means.

4. Fumigation with carbon bisulphide, hydrocyanic-acid gas, or some other fumigant.

Sterilization of infested tobacco by means of exposure to Roentgen or X rays.

The senior author while in Cuba in 1922 observed that cigars were not boxed as soon as they were ready, on the ground that

boxed cigars are susceptible to the attack of the beetles. Whereas as long as the cigars are left in the large drawers, receiving some light therein now and then, the insect seems to show a marked shyness about attacking them. It is possible that this particular insect prefers to attack in the dark as a habit.

The control of the cigarette beetle by freezing, that is, by cold storage is now being practised in the Philippines, but probably because of the high cost of the method only the valuable wrappers are thus safeguarded. Subjecting the cigars to a high temperature or steam is at present universally done in the Philippines. Practically all of the principal Philippine factories are equipped with either a vacuum chamber or a special steam dryer or both to control beetles and to sterilize tobacco products. The control of the beetle by trapping is merely taking advantage of the fact that the beetles, like most insects, are attracted by light. This method is not practised in the Philippines to a very large extent.

Although Mackie (1917) conducted a number of successful experiments on the control of the cigarette beetle by fumigation, in the Philippines, the Philippine tobacco manufacturers are still apparently lukewarm toward this method of control. The fumigant used was carbon bisulphide and the apparatus, a vacuo-fumigation chamber, requiring only five operations: closing door, awaiting desired rise in temperature, starting pump, opening valves, and removing the material. Bearing in mind how beetles attacking grains and even flour are successfully controlled by fumigation, this method seems promising against the tobacco beetle in the Philippines. If the tested methods of control by fumigation in the Philippines have been found in any way impractical or too expensive, more tests should be conducted until more practical and economical methods are found.

The control of the beetle with Roentgen or X rays in the Philippines is at present out of the question, mainly because of the costliness of the method.

The beetle is partly checked by certain predaceous insects, the most important being the clerid beetle, *Thaneroclerus girodi* Chabrolat as reported also by Runner.

Remedies are the same for the cigarette beetle as for the other beetles that are found to infest dried tobacco.

Fungi.—Mackie (1917) reported that True, in an interesting paper entitled "The Molds of Cigars and Their Prevention," has shown four molds to be present on cigars, the most common of which is *Aspergillus candidus*, a species which was identified

by Doctor Yates, former mycologist of the Bureau of Science, as the one that is the cause of complaint against Manila cigars. This species together with Penicillium are the most prevalent molds found on cigars, and "will not grow on the wrapper leaves in the absence of some other substance, foreign to the leaf, which might act as a source of food for the fungi. In line with this fact, the possible infection through paste was found controllable by True and later by Mackie using boric acid at the rate of 3.8 parts per hundred parts of water and stirring until the acid is all dissolved. Use this solution instead of water in making up the paste.

Great care should be taken not to use more paste than is necessary, as it is liable to be smeared over the surface of the cigars. Again there is the factor with respect to the kind of paste being used. The experience of many factories has established the fact that gum tragacanth is the best.

What really renders the problem of mold on tobacco very important in the Philippines is the fact that the Philippines, as a tropical country, is subject to heat with a very high relative humidity, a condition favorable to the development of molds. For this reason Philippine tobacco factories, particularly those making cigars, are equipped with a system or systems of heaters in a specially designated tobacco drying room, in order to insure the drying of the cigars particularly, in an atmosphere hot enough and dry enough to prevent mold infection.

The experience of Mackie (1917) with a drying room artificially heated shows that 95° F. is hot enough for all purposes. He also described a heater that gives a maximum heat for the amount of fuel consumed:

"Such a heater equipped for gas consumption with burner arranger in tubular form and aggregating 160 lineal inches of actual burner space, should, if inclosed, and with an air current from a blowing fan passing over the heater, raise the temperature of this air to 50° C. and maintain a temperature of 35.6° C. in a room having a capacity of 12,000 cubic feet. This temperature could be raised or lowered according to the amount of time the blowing fan is operated and the size of the fan employed. All reliable makes of blowers give the following: pressure in ounces per square inch of duct; velocity of air escaping per second or per minute; and volume discharged in one minute through effective area in cubic feet.

"The efficiency of such a heater will be greatly enhanced by a proper distribution of the air through ducts to different parts

of the room. The location of these can be arranged to suit the shape of the room. In placing air ducts, it should be remembered that sharp angles tend to greater loss in heat transmission. Blind ends should always be avoided. All ducts should be well insulated, preferably with asbestos.

"The proper position of outlets of escaping air is a matter which is often vexing. Generally speaking, where the weight of the material is greater compared to the moisture to be evaporated, heating of the material becomes an important factor. With tobacco, this will necessarily be done by radiation and from below, while outlets at the top will be found most convenient."

The above in brief, summarizes the points which are essential and which should be well understood by anyone contemplating the construction or operation of an artificially heated drying room.

Some manufacturers claim that spraying or washing the tobacco leaves or products with rum renovates them when they are in a musty or moldy condition.

The Collector of Internal Revenue in his Twenty-Second Annual Report (1925) pointed out that during the year 1925 it cost the Philippine Government ₱61,088.56 for reconditioning cigars and refunding the value of stamps destroyed incidentally, in conformity with the provisions of section 10 of Act 2613 as amended and better known as the Tobacco Law that expenses incurred in reconditioning worm-eaten, musty or moldy Philippine cigars in the United States shall be borne by the Insular Government. This shows that the tobacco beetle and saprophytic fungi attacking stored and manufactured products of tobacco in the Philippines are still at large. And if the prevailing methods of control of the pests and diseases are inadequate, efforts should be made to find better ones and, if necessary, extensive experiments should be conducted for the further study of their control. Some time ago Mr. Sinforoso Prieto of Manila, under the auspices of the Tobacco Board, tried to demonstrate the immunization of tobacco from mold and worm but after that demonstration nothing has been heard about it.

ADDITIONAL NOTES ON THE APPLICATION OF SCIENCE TO TOBACCO MANUFACTURE

The application of science to tobacco manufacture may be direct or indirect. It is indirect when it concerns only the production of the leaf material used until it reaches the factory,

and direct when it concerns any process within the factory. From the time the tobacco seed is sown until the finished tobacco product leaves the factory, agricultural science, applied biology, chemistry, physics, and bacteriology play an important rôle in the improvement of the tobacco industry as a whole.

Agricultural science.—To agricultural science in its broadest aspect belongs the intricate rôle of producing the specific leaf tobacco material used in the different kinds of tobacco manufacture. Any worker who has handled the tobacco plant realizes how the culture of tobacco scientifically may be considered as only started. There are today up-to-date experiment stations, complete as to personnel and equipment, the most notable being the famous Deli Proefstation in the Island of Sumatra devoted wholly to research work on tobacco alone. The response of the tobacco plant to various cultural methods, seed selection, climatic conditions, and to different soils and fertilizers affects its yield and quality so greatly that only long years of research can enlighten the producers as to the best combinations of these factors for their particular requirements. For the purposes of this paper, only specific examples are cited.

An instance of the significance of cultural methods is the effect of distancing on the texture of the tobacco leaf. The greater the distance, the coarser the leaf produced.

There are several varieties or races of tobacco, a fact that is well known, and just as in the case of mankind, each race and variety possesses peculiar characteristics. It is the duty of the plant breeder to study these characteristics and improve them by intensive seed selection within pure lines and, if necessary, to cross them to obtain combinations of desirable characteristics found originally in different varieties. A uniform product is only obtainable from a crop of a pure seed or variety and a variety or race may be adaptable for filler or wrapper purposes, for dry or wet season, etc. The best example of an improved strain of tobacco as a result of hybridization is the so-called "Round Tip" now grown in the Connecticut Valley, U. S. A. It possesses combined the round tip of the Sumatra variety and the large size of the leaf of the Havana variety.

The success so far attained by the Bureau of Plant Industry in the production of wrapper and aromatic cigarette tobacco lies in the successful introduction and acclimatization of the Sumatra, Virginia and Turkish varieties. It is necessary that a variety possessing tendencies or characteristics to produce the

desired new materials be available so the introduction may be started.

An experiment conducted at the Ilagan Tobacco Experiment Station of the then Bureau of Agriculture during two tobacco seasons has shown that alluvial soils produce finer and lighter leaves than clay soils. The experiment demonstrated that different varieties show different response to the two kinds of soils. For example, the Pampano No. 1 variety will yield more than the Repollo on an alluvial soil, but on clay soil the response is different. As to fertilizers, we can get an idea of this effect on the burning quality of tobacco from the following conclusions of Garner (1907):

"The principal objects to be attained in efforts to improve the burning qualities of tobacco by breeding and by improved methods of production, especially in the use of the proper fertilizers, are (1) a relatively high content of potash combined with citric and malic acids, with a minimum amount of inorganic salts, especially chlorides and sulphates; (2) a moderate content of lime; (3) a comparatively small percentage of magnesia, and (4) a low content of organic nitrogenous compounds, more especially the albuminoids or proteids. Of these problems the first mentioned is altogether the most important from a practical standpoint and also the most difficult to solve. It has long been known that the muriate can not be used as a source of potash in the production of tobacco which is intended for smoking purposes, because of the injurious effects of the chlorine. The other available sources of potash at the present time are the sulphates, the carbonates, and the silicates."

Applied biology.—Among the branches of this broad subject which have application in tobacco are botany and entomology. The first because seed selection and hybridization of tobacco cannot be successful without a proper knowledge of taxonomy and morphology, or the anatomy and physiology of the plant, as a working basis. And then we must add to these that subbranch of botany which has assumed tremendous importance recently in the science of plant breeding, the science of sexuality and inheritance in plants. In the production of wrapper leaf tobacco, for example, it is not sufficient that the texture shall be fine. It must have a well-developed cuticle to withstand the strain of handling it, especially during the wrapping operation. Recent experiments also point to actual structural differences in the three specific regions of the same leaf, namely, the basal, central,

and apical areas. And it is already an established fact that different varieties of tobacco have peculiar physiological behaviours, particularly in nicotine content.

Chemistry and physics.—In the last paragraphs under cigar manufacture, mention was made of the composition of leaf tobacco and its relation to the quality of cigar tobacco. Mention was also made under cigarette manufacture of the peculiarities of the cigarette paper. And the flavoring of tobacco was touched upon in passing under cigarette and chewing tobacco. All these subjects are covered by the science of chemistry. Soils and fertilizers must be analyzed for adaptability to tobacco, and the ingredients used for insecticides and fungicides in the control of tobacco insect pests and diseases are chemicals. So it can be seen that chemistry plays an important rôle in the production and conservation of tobacco. The proper control of moisture and temperature in the curing and fermentation of leaf tobacco as well as the relation of these factors to the conservation of manufactured tobacco products, as in the case of the drying of cigars in a special drying room already discussed, belongs to the realm of physical science.

Bacteriology.—This subject is taken up separately although it is a part of biology because of its growing significance in the curing, fermentation, and quality of leaf tobacco. Some time ago the Government Tobacco Board authorized the demonstration of a quick method of tobacco fermentation by a German scientist at Manila and at the Ilagan Tobacco Experiment Station. Although this scientist gave no hint as to the nature of his treatment, there can be no question, as later corroborated by certain chemists of the Bureau of Science, that the liquid with which he sprayed the tobacco leaves contained cultures of bacteria. As a matter of fact Schmidt (1925) summarized the relation of bacteria to tobacco as follows:

1. That bacteria (not pathogenic) occur even in green tobacco leaves.

2. That there are different groups of bacteria—each group having different ability to produce different degrees of temperature (fermenting).

3. The flora of the microörganisms of different countries and tobacco of different qualities are different with regard to (*a*) number of specimens and (*b*) the specimens among themselves.

4. Referring to classes, there is a big difference between German and foreign tobacco. Bacteria found in foreign tobacco can

not be isolated in German tobacco. But the bacteria belong to the same groups. This accounts, perhaps, for the difference in quality of the two kinds of tobacco.

5. There is also the difference in the fermentation of German and American tobacco; hence the differences in the bacteria in each.

6. In Ohio (American) tobacco of good quality only *Mesentericus* bacteria are found but *Coccus* forms are also found in tobacco of bad quality.

7. *Plectridium* and *Clostridium* bacteria are found only in tobacco of poor quality.

8. There are five groups of bacteria in all found in fermenting tobacco, each group manifesting a different reaction to proteins and carbon dioxide.

The so-called petuning of tobacco, a custom consisting of sprinkling the unripened leaves with a liquid prepared by infusing old tobacco, mixing water with molasses, rum, etc. is practised in the United States. This practice would naturally either stimulate the growth of desirable bacteria or infect the leaves with the bacteria of desirable varieties, especially those with special aromatic qualities, says Jordan (1920).

Such briefly are the important points whereby science finds application directly and indirectly in tobacco manufacture, which show that there is yet much to do in the different branches of science for the promotion and stabilizing of the industry, and that all necessary research work should be continued and amplified. This needs the coöperative efforts of the Government and all other parties concerned.

SANITARY CONTROL OF THE FACTORIES OF TOBACCO PRODUCTS

The following rules and regulations for the sanitary control of the factories of tobacco products are quoted verbatim from Health Bulletin No. 28 issued by the Director of Health and effective December 2, 1924, to show clearly that Philippine tobacco factories are being operated under the strictest sanitary conditions:

SECTION 1. *License.*—Any person, corporation, firm, or association desiring to run, operate, open, or engage in the business of manufacturing tobacco products such as cigars, cigarettes, smoking or chewing tobacco, snuff, and all other forms of manufactured and partially manufactured tobacco, shall make application therefor to the Collector of Internal Revenue, who shall, prior to the issuance of the necessary license in accordance with section 1555 of the Administrative Code, refer such application to the Di-

rector of Health for the sanitary inspection of premises. All licenses issued under section 1555 of the Administrative Code shall bear the concurrent approval of the Director of Health.

SEC. 2. *Sanitary labels.*—Factories attaining the standard of sanitation required by the Philippine Health Service may affix to boxes, bundles, and packages containing cigars, cigarettes, smoking and chewing tobacco of said factories label of inspection by the Philippine Health Service combined with that of the Bureau of Internal Revenue, on the boxes, bundles, or packages, as the case may be, in such a way that in opening them the labels are broken. These labels shall only be affixed on products of factories attaining a sanitary score of 85 per cent perfect.

SEC. 3. *Manufacturers to assist officers and employees of the Philippine Health Service.*—Manufacturers of tobacco products shall furnish assistance to Philippine Health Service officers and employees upon demand for the purpose of inspecting any part of the factory premises, measuring the areas thereof, and examining the laborers.

SEC. 4. *General sanitary provisions.*—It shall be the duty of every manufacturer of tobacco products or his manager to keep the building or buildings in which such business is carried on in a clean and sanitary condition as prescribed by the Director of Health. To comply with the requirement, he shall, among other things, keep the floors swept and scrubbed, rubbish removed, and walls and ceiling cleaned in such a manner and form as directed by the Director of Health or his authorized representative.

SEC. 5. *Air space.*—Manufacturers of tobacco products shall maintain at least 6 cubic meters of air space for every employee in rooms having a window area from one-tenth to one-fifth of the floor area, and at least 5 cubic meters of air space for window area equal to or greater than one-fifth of the floor area. Rooms having a window area less than one-tenth of the floor area shall not be used as work rooms.

SEC. 6. *Closets.*—Every manufacturer of tobacco products shall maintain separate closet accommodations for men and women, and shall equip the factory with one or more properly constructed, installed, and ventilated sanitary closets for each fifty employees of the sex using such accommodations. In addition to the required number of sanitary closets, there shall be one properly constructed and installed urinal for every sixty male employees of the factory. In municipalities where there is no sewer system, septic vaults should be constructed, the size to vary according to the maximum number of cigar makers the factory can employ. The specifications of the Philippine Health Service regarding such requirement shall be followed.

SEC. 7. *Wash rooms.*—In every factory there will be provided in connection with or easily accessible from the toilet room for each sex, a properly equipped lavatory with an adequate supply of water, soap, sanitary towels, and one or more wash basins for each fifty employees of the sex using such accommodations. The management of the factory may require the employees to supply themselves with the necessary towels but shall be responsible for seeing that the employees do so in such a case.

It shall be obligatory upon the management of the factory to maintain said toilet rooms and lavatories in a sanitary condition satisfactory to the Director of Health or his authorized representative. In places where

there is no water system, artesian water or water from surface wells constructed and kept in accordance with the specifications and requirements of the Philippine Health Service may be used, in which case the factory must be provided with a tank in which a sufficient amount of water for factory uses shall be stored.

The drainage of the factory premises must be such that no stagnant water will remain in the buildings and its immediate surroundings.

SEC. 8. *Washing of hands.*—Every laborer, workman, operator, or any other employee of a tobacco factory who is engaged in the handling, cleaning, preparation, manufacture, or packing of cigars, or other products of tobacco manufactured for human consumption, upon each arrival at the factory, before beginning work, and after each visit to a closet or urinal and before resuming work, shall wash his or her hands thoroughly with soap and water and shall dry them with a clean towel. When required by the regulations of the Philippine Health Service, the hands shall also be washed with a suitable disinfecting solution.

The owner or manager of a tobacco factory shall detail a sufficient number of employees for the purpose of enforcing the requirement with reference to the washing of the hands of the employees.

SEC. 9. *Cuspidors.*—There shall be provided in every room of a tobacco factory at least one cuspidor for every eight persons. No person shall expectorate or deposit any mucus or phlegm on the floors or walls in or about such factories. The cuspidors herein required shall be of an impervious material with smooth polished surfaces, so as to be easily cleaned, and shall be emptied, cleaned with water and partially filled with disinfecting fluid every day, or oftener when so required by the Director of Health or his authorized representative.

An employee of the factory shall be detailed for this work by the owner of the factory or its manager, to see that the provisions of this section and the preceding one are carried out.

SEC. 10. *Wearing apparel, handkerchiefs, etc.*—No employee of any tobacco factory shall use any wearing apparel, such as handkerchiefs, *tapis*, or similar articles for the purpose of holding, wrapping, or conveying from one place to another, any tobacco or tobacco products.

The laborers engaged in the preparation, manufacture, or handling of the cigars, cigarettes, or other tobacco products may be required by the Director of Health or his authorized representative, at the expense of the factory, to wear clean, white muslin aprons with sleeves and caps before commencing work and may also be required to have their finger nails closely trimmed.

It is absolutely prohibited to hang or place any part of the clothing of the laborers or employees in any part of the room where tobacco manufacturing is carried on, except in the one assigned for this purpose.

SEC. 11. *Restaurant, living rooms, peddlers.*—No restaurant, canteen, or carinderia, shall be permitted or allowed in the interior of any cigar, cigarette, or any tobacco products factory, nor shall any part of the building in which the manufacture of tobacco is carried on be used for living or sleeping quarters, unless the part so used is entirely separated from the part of the building used as factory and has no interior connection

therewith. No peddler shall be allowed to enter the factory premises for the purpose of selling fruits, sweets, aërated waters, or any articles of food or drink.

A suitable dining room with proper sanitary equipment entirely separated from the part of the building used as working rooms and having no interior connection therewith may be set aside if previously approved by the Director of Health, and shall be maintained at all times in a good sanitary condition for the exclusive use of the laborers and employees of the factory. Eating in any part of the building except in the dining room and using a common drinking cup are absolutely prohibited. It is the duty of the manager or owner of the factory to provide safe drinking water for the laborers and employees in accordance with the rules and regulations as required by the Director of Health.

SEC. 12. *Children.*—No employees of any cigar, cigarette, or tobacco factory, during the hour of employment therein, shall be accompanied by or receive visits from any child who is not employed for pay in the same factory.

SEC. 13. *Domestic animals not allowed in factory premises.*—No domestic animals shall be permitted to enter and remain in the factory.

SEC. 14. *Sanitary preparation and manufacturing of tobacco products.*—All manual operations pertaining to the selection and classification of leaves, the preparation for, and the manufacture of tobacco products shall be carried on in a sanitary manner in properly ventilated and lighted rooms, upon dry clean tables, or upon dry clean mats spread upon floors or tables and so protected by troughs, flanges, or other satisfactory devices that the material employed may be kept from falling on to the floor and from contamination from any other source. This section shall not be constructed as prohibiting the use of dry, clean, smooth impervious pavements, which have aisles so arranged as to prevent the tobacco from being stepped upon.

Cigars must not be placed, to be dried, upon the pavement or floor. If the drying room is located on the ground floor the rack or framework should be at an elevation of not less than one meter if the ground is unpaved, and not less than one-half meter if paved. In no case should cigars while being dried be closer to the ground than one meter or one-half meter in the respective cases above mentioned.

SEC. 15. *Insanitary acts.*—No person engaged in the handling, preparation, processing, manufacture, or packing of tobacco product or supervising such employment, shall perform, cause, permit, or suffer to be permitted any insanitary act during such employment, nor shall any such person touch or contaminate any tobacco products with filthy hands or permit the same to be brought into contact with the tongue or lips, or use saliva, impure water, or other unwholesome substances as moistening agent, nor any such person trample, walk, or stand upon such tobacco or tobacco products or permit or suffer the same to be done. Care should also be taken, especially by women employed in the factory, that no loose hair should be allowed to fall and mix with the tobacco under process of manufacture. To this end, no women workers will be allowed to have their hair remain loose while within the factory premises.

Containers of paste used in the manufacture and packing of cigars and cigarettes shall be washed every morning. The use of paste left over from previous day is prohibited.

SEC. 16. *Dangerous communicable diseases; medical inspection and certificates.*—No person suffering from a dangerous communicable disease shall be employed in any factory. For the purpose of making this provision effective, every employee of a tobacco factory shall be inspected by a duly qualified physician within twenty-four hours of original entrance upon and every two weeks thereafter during each employment.

The fact that such inspections have been made shall be evidenced by the initials of the physicians placed on individual report cards and properly kept alphabetically by names with an index card guide. These cards shall contain all the data as per sample attached, and shall be furnished free by the factory to the employees upon request. The physician shall keep a record of the inspection of each case of dangerous communicable disease, showing date, name, age, address, and findings which record shall be subject to examination by the proper representative of the Director of Health at any time. There shall be on file in the factory a card for each employee. No tobacco worker who has been working previously in another cigar factory shall be admitted to a new factory without presenting his or her medical certificate card from the former factory where he or she was working, showing that he or she is free from contagious, infectious, desquamative disease. This semimonthly inspection shall not prevent the inspection at any time of any or all employees, male or female, by a health officer whose decision in matters of disease and sanitation shall be final upon approval thereof by the Director of Health.

It shall be the duty of new employees to appear before the health officer of the district or town in which the factory is located for the checking of their cards, and to be vaccinated or inoculated in case of necessity. In factories located in municipalities where there are no physicians available, the employees should submit themselves for inspection to the local health officer on the first and tenth of every month.

SEC. 17. *Inspection of factory for sanitary purposes.*—All tobacco factories shall be subject to inspection by the Director of Health or his authorized representative without previous notice, upon reporting to the owner, representative, or person in charge of same if he is on the premises, before making inspection, which may be made any hour of the day or night when work is being performed, for the purpose of ascertaining whether these rules and regulations are properly observed and enforced.

SEC. 18. *Reports of violation.*—It shall be the duty of every owner or manager of a tobacco factory, when any one of his employees violates any provision or provisions of these rules and regulations, to report same forthwith to the Director of Health or his authorized representative.

SEC. 19. Any violation of the provisions of this section shall be sufficient cause for the immediate closing of the factory by the Collector of Internal Revenue.

SEC. 20. All regulations previously issued which are inconsistent with the provisions hereof are hereby repealed.

Part IV. THE PHILIPPINE TOBACCO TRADE

The tobacco industries of most countries, with the exception of a few like the United States and the Philippines, are monopolies. There is no other farm crop that is as rigidly regulated and as heavily taxed in its movement as tobacco and its manufactured products. Customs duties, surtax, turnover tax, excise tax and privilege tax of leaf tobacco dealers and manufacturers are some of the government charges on tobacco and its manufactures. Tobacco import duties are very high and vary in different countries from 10 per cent to 100 or more per cent ad valorem. Even the internal movement of tobacco and its manufactures are strictly regulated by the Government. Yet in spite of all these impositions the Philippine tobacco industry stands today as one of the most important industries of the country. As a matter of fact, it is the oldest established industry of the islands and serves as an important source of government revenue. Revenues collected by the government from tobacco in 1938 amounted to over ₱10,000,000. This collection is in the form of sales tax, specific tax, privilege tax and inspection fees.

Not considering the growers' consumption which is about 8,000,000 kilos, representing about 10 per cent of the total production, the legitimate industry and commerce dealt with has an average yearly volume of 34,251,417 kilos distributed as follows:

	Percentage of production
Raw leaf exported to Spain	37.90
Raw leaf exported to other countries	17.70
Stripped tobacco, etc. exported to United States	3.80
Stripped tobacco, etc. exported to other countries	0.80
Leaf used in local factories including loss through stemming waste, etc.	39.80
	100%

Leaf tobacco is exported to 25 countries, the biggest buyers being Spain, Italy, France, Korea, French Africa, China, Hongkong and Netherlands. Cigarettes are exported to 22 countries. The leading buyers are Portugal, Japan, United States, Great Britain and Spain. Tobacco scraps, stripped fillers, and cigar ends are exported to 10 countries, of which the United States, Netherlands, Belgium, French Africa and Gibraltar are the ranking buyers. Very little smoking tobacco is exported, the bulk of it going practically to Spain, China, British East Indies,

and Hongkong. Exports of all other tobacco products are very negligible, finding their way to British East Indies, China and Hongkong. Cigars form the heaviest export valued at ₱6,290,510 in 1939, with leaf tobacco making a close second valued at ₱5,672,136 and tobacco scrap ranking third valued at ₱2,495,649. Our cigarette export is worth only ₱69,725 in 1939; and smoking tobacco and all other tobacco products, ₱698 and ₱428 respectively in the same year.

PHILIPPINE TOBACCO IMPORTS

Philippine imports of tobacco and tobacco products in the form of cigarettes, leaf tobacco, chewing and smoking tobacco amounted to ₱13,944,760 in 1939. This importation comes mostly from the United States in the form of cigarettes, wrapper & Virginia leaf tobacco, smoking and chewing tobacco. The only significant import coming from another country is our importation of around 4,000 kilos of Sumatra wrapper from the Dutch East Indies, valued at about ₱51,299 in 1938. It appears, therefore, that our tobacco imports from the United States constitute 99.59 per cent of our total imports—a virtual monopoly—while exports of the same products to the United States constitute only about 64 per cent of our total exports. There is a great upward trend in our domestic consumption of imported American cigarette at the expense of the native cigarette. Whereas about 92 per cent of our total consumption of cigarettes were of local manufacture in 1926, it went down to around 49 per cent in 1938, the remaining 51 per cent being supplemented by imported American cigarettes. The advent of the American régime gradually changed the course of trade not only on tobacco but practically on all the principal export crops. The free trade legislation passed by the American Congress in 1909 developed the export trade of tobacco and other Philippine products to the United States. This trade relation became reciprocal; as a consequence the United States is today the best market of Philippine export crops.

PHILIPPINE TOBACCO EXPORTS

The total Philippine tobacco exports for the year 1939 were as follows: Leaf tobacco, 16,495,403 kilos; cigars, 207,073,373 units; cigarettes, 28,664,840 units; all other tobacco products, 5,717,970 kilos. These exports have a total value of around ₱14,529,146 distributed as follows: Leaf tobacco, ₱5,672,136; cigars, ₱6,290,510; cigarettes, ₱69,725; smoking tobacco, ₱698; all other tobacco products, ₱2,496,077 (mostly scrap).

The leading importers of Philippine tobacco named in the order of their importance are:

CIGARS

1. United States
2. China
3. Hawaii
4. British East Indies
5. Hongkong
6. Great Britain
7. France
8. Spain
9. Japan
10. French East Indies
11. Switzerland
12. Netherlands
13. Japanese China
14. Egypt
15. British Africa
16. Gibraltar
17. Australia
18. Dutch East Indies
19. New Zealand
20. Norway
21. Panama
22. Denmark
23. Portugal
24. Guam
25. Sweden
26. Germany
27. Belgium
28. Aden
29. Dutch West Indies
30. Portuguese East Indies
31. Korea
32. Argentina
33. Turkey in Asia
34. Persia
35. Portuguese China
36. Palestine
37. Greece

TOBACCO SCRAPS, STRIPPED

1. United States
2. Netherlands
3. Belgium
4. French Africa
5. Gibraltar
6. New Zealand
7. Japan
8. British East Indies
9. China
10. Dutch East Indies

SMOKING OR CUT TOBACCO

1. Spain
2. China
3. British East Indies
4. Hongkong
5. French East Indies
6. Canary Islands.

ALL OTHER TOBACCO PRODUCTS

1. British East Indies
2. China
3. Hongkong
4. United States

LEAF TOBACCO

1. Spain
2. Italy
3. France
4. Korea
5. French Africa
6. China
7. Hongkong
8. Netherlands
9. Guam
10. Gibraltar
11. Australia
12. British East Indies
13. Japanese China
14. Belgium
15. Great Britain
16. Dutch East Indies
17. Uruguay
18. United States
19. Hawaii
20. French East Indies
21. British Africa
22. New Zealand
23. Czechoslovakia
24. Thai

CIGARETTES

1. Portugal
2. Japan
3. United States
4. Great Britain
5. Spain
6. Hongkong
7. Egypt
8. China
9. Portuguese East Indies
10. Hawaii
11. Norway
12. British East Indies
13. French East Indies
14. Japanese China
15. Australia
16. Netherlands
17. Guam
18. Dutch East Indies
19. Denmark
20. Germany
21. France
22. Canary Islands.

From the above list, it can be seen that there are 37 countries buying our cigars led by United States, China, Hawaii, British East Indies, Hongkong and Great Britain.

LOCAL CONSUMPTION

Reviewing the two-year period, 1937–1938, the average yearly production of manufactured tobacco products was as follows:

Cigars	311,812,353 units
Cigarettes	3,265,951,880 units
Chewing and smoking tobacco	207,275 kilos
Scrap, cigar butt, stripped filler, etc.	2,447,065 kilos

The local consumption of tax-paid manufactured tobacco products may be sufficiently demonstrated by the 1937–1938 statistics as follows:

Tobacco products		1937		1938	
		Total	Per cent Local	Total	Per cent Local
Cigars	Nos.	113,234,283	99.21	104,979,215	99
Cigarettes	Nos.	6,202,377,775	51.9	6,570,230,353	48
Smoking tobacco	Kgs.	251,670	82.17	221,258	85
Chewing tobacco	Kgs.	536,987	40.36	541,629	38.8

The above data of local consumption include both local and imported products. Local consumption of tax-paid domestic products is about 8 per cent of the total production, while the growers' consumption of around 8,000,000 kilos untaxed is 19 per cent of total production, thereby making our total consumption about 27 per cent of the total production, or partially one-third of the total yearly production.

Our consumption of imported cigarettes which is the biggest item of our tobacco imports is around 3,423,825,508 units in 1938 or about 51 per cent of our yearly total cigarette consumption. This import of American cigarette is valued at around ₱11,000,000 annually.

PHILIPPINE FOREIGN TOBACCO TRADE

The Philippine tobacco export trade during the Spanish régime and particularly at the time the monopoly was in operation has been almost confined to Spain.

Our tobacco trade with European countries was disturbed by the long-drawn revolution in Spain, but it is expected that with the termination of the hostilities the trade will go back to normal.

The United States stands today as the biggest single market of Philippine tobacco, particularly cigars. Whether this market can be presumed to be permanent will depend upon the future political and economic relationship between the two countries. It was feared at first that because of the provisions of the Independence Act the tobacco industry of the Philippines might soon lose its market in the United States. Fortunately, however, the United States Congress in 1939 enacted a measure (Public Act No. 127 as amended by Public Act No. 300) amending the Independence Act to the effect that, instead of a graduated tariff, Philippine tobacco products, exclusive of cigarettes, cheroots of all kinds and paper cigars and cigarettes including wrappers which may be shipped from the Philippines into the United States, free of duty, are subject to quotas. It means that only cigars and scrap tobacco and other stemmed and unstemmed filler tobacco can enter the United States duty free beginning on January 1, 1940 and ending on July 3, 1946 subject to a 5 per centum reduction every year. For example, in the case of cigars, the 1940 quota being 200,000,000, the quota in 1940 would be 180,000,000; in 1942, 171,000,000; in 1943, 162,450,000, etc.

For the period January 1, 1946 to July, 1946, however, the quota shall be one half of the corresponding quota for the calendar year 1946.

As regards scrap tobacco, stemmed and unstemmed tobacco as described in paragraph 602 in the United States Tariff Act of 1930 the initial quota in 1940 is 4,500,000 pounds. A reciprocal tobacco trade between the two countries is very desirable

especially when it is considered that besides our tobacco imports from the United States we practically purchase all the tobacco machinery and other commodities utilized in the tobacco manufacturing industry from said country. This fact renders this trade always in favor of the mother country.

A vivid picture of the present status of the Philippines-United States tobacco trade is clearly seen in the following 1937 report (on tobacco) of the Collector of Internal Revenue who administers Act No. 2613, as amended, otherwise known as the Tobacco Inspection Law:

"THE TOBACCO PROMOTION WORK OF THE BUREAU

"*The Philippine cigar trade in the United States.*—During the year 1937, there were exported to the United States 187,779,816 cigars which, compared with 164,905,078 sent to that country in 1936, shows an increase of 22,874,738, or 12.18 per cent. The increase was due, to a large extent, to the renewed efforts of the manufacturers in this country to ship cigars of high quality so as to increase the sale of the two-for-a-nickel-class cigars sold in the United States market which find acceptance among the American smokers. In view of this come-back, the eventual recovery of the ground formerly occupied by Philippine cigars in the American market is expected. While a moderate increase was registered in the quantity of cigars exported to the United States, the average price paid per thousand remained practically the same as that of the previous year. This is an indication that the American importers have to maintain the same low price level for cigars, otherwise, the Philippine cigars could not survive the stiff competition offered by American manufactured cigars which are sold at two for five cents.

"The credit for the significant gain in the sales of Philippine cigars in the United States should also be given to Messrs. C. A. Bond and D. F. Morris, Philippine tobacco agents in that country, whose activities in disseminating valuable information regarding the quality of the Philippine cigars were carried on more vigorously during the year under review. To make their work effective, they visited different sections of the United States, exerting their utmost efforts to introduce Manila cigars in cities or districts where our cigars are unknown, and endeavoring to increase the demand for our cigars in places where they have maintained a foothold. They also endeavored to verify whether the requirements of this Bureau in fixing the minimum prices at which Philippine cigars should be sold in the American market were being followed by the importers. They reported that the sale of the two-for-five-cent cigars continued to decline and they advised the Philippine manufacturers to increase their exports of the five-cent cigars and other high-priced cigars. As the American importers had shown no disposition to abandoning the sale of the two-for-five-cent cigars, the manufacturers in the Philippines were reluctant to heed the advice of the Philippine tobacco agents in the United States.

"EXPORTS TO THE UNITED STATES IN DETAIL

"The following table indicates the number of cigars exported to the United States and territories during the last nineteen years and the average price per thousand:

Year	Number of cigars exported	Average price per 1,000
1919	261,514,367	₱53.14
1920	321,616,983	65.16
1921	73,303,964	55.25
1922	174,186,363	49.01
1923	219,702,360	52.25
1924	185,536,675	56.98
1925	212,873,752	47.76
1926	205,995,581	47.04
1927	173,190,208	43.29
1928	187,360,260	42.01
1929	156,641,727	40.85
1930	154,134,414	39.43
1931	166,193,165	36.34
1932	176,259,204	34.45
1933	185,056,249	30.52
1934	208,268,782	31.10
1935	208,676,183	29.99
1936	164,905,078	30.28
1937	187,779,816	30.35
1938	185,871,272	30.16

"The wrappers used for the cigars sent to the United States and territories are estimated as follows:

Year	Total number of cigars	With U. S. wrappers	With Sumatra wrappers	With Philippine wrappers
		Per cent	*Per cent*	*Per cent*
1919	261,514,367	2.00	2.75	95.25
1920	321,616,983	1.00	3.05	95.95
1921	73,303,964	2.85	3.05	95.95
1922	174,186,363	2.00	2.65	95.45
1923	219,702,360	4.25	3.75	92.00
1924	185,536,675	8.35	2.65	89.00
1925	212,873,752	10.50	2.15	87.35
1926	205,995,581	54.67	1.12	44.21
1927	173,190,208	45.05	1.86	53.09
1928	187,360,260	56.72	.76	42.52
1929	156,641,727	41.50	3.70	54.80
1930	154,134,414	37.69	2.98	59.33
1931	166,193,165	39.54	2.58	57.88
1932	176,259,204	48.13	1.63	50.24
1933	185,056,249	56.48	2.01	41.51
1934	208,268,782	75.75	.22	24.03
1935	208,676,183	78.14	.25	21.61
1936	164,905,078	82.71	.38	16.91
1937	187,779,816	86.75	.24	13.01
1938	185,871,272	87.32	.21	12.47

"The following table indicates that the bulk of the trade in the United States and Hawaii is built on Class A cigars:

Class	Tax per M.	1933	1934	1935	1936	1937
A	$2.00	184,733,304	207,571,212	208,181,968	164,317,208	186,908,646
B	3.00	166,990	516,695	299,965	322,330	314,380
C	5.00	152,955	178,275	160,830	129,930	193,690
D	10.50	800	600	32,830	129,860	350,850
E	13.50	2,200	2,000	1,250	5,750	12,250
Total		$185,056,249	208,268,782	208,676,183	164,905,078	187,779,816

"That the tobacco trade in the United States and territories is not entirely confined to the exportation of cigars can be seen from the following tables:

CIGARS

Quarter	1933	1934	1935	1936	1937
First	30,191,261	55,781,951	53,711,912	38,410,167	32,546,841
Second	30,675,410	55,176,473	48,215,685	42,068,417	45,062,665
Third	54,468,050	33,242,881	52,321,200	46,141,548	53,077,667
Fourth	69,721,528	64,067,477	54,427,386	38,284,946	57,092,643
Total	185,056,249	208,268,782	208,676,183	164,905,078	187,779,816

CIGARETTES

Quarter	1933	1934	1935	1936	1937
First	670,800	548,300	419,900	115,000	480,000
Second	221,100	700,200	519,650	197,000	252,000
Third	218,450	196,500	351,450	180,000	128,400
Fourth	454,000	461,600	395,000	251,000	113,550
Total	1,564,350	1,906,600	1,686,000	743,000	973,950

PARTIALLY MANUFACTURED TOBACCO

Quarter	1933		1934		1935	
	Stripped tobacco	Scrap tobacco	Stripped tobacco	Scrap tobacco	Stripped tobacco	Scrap tobacco
	Kilograms	*Kilograms*	*Kilograms*	*Kilograms*	*Kilograms*	*Kilograms*
First	113,541	72,214	119,494	81,132	91,588	332,003
Second	53,226	66,755	99,646	71,287	167,633	161,462
Third	54,544	200,681	35,235	60,596	91,419	196,509
Fourth	133,083	156,108	88,065	204,612	95,249	219,116
Total	354,394	495,758	342,440	417,627	445,889	909,090

PARTIALLY MANUFACTURED TOBACCO—Continued

Quarter	1936		1937	
	Stripped tobacco	Scrap tobacco	Stripped tobacco	Scrap tobacco
	Kilograms	*Kilograms*	*Kilograms*	*Kilograms*
First	101,555	100,097	240,622	365,351
Second	116,729	181,038	283,944	458,900
Third	111,193	94,350	283,910	426,040
Fourth	111,296	175,288	353,355	390,985
Total	440,773	550,773	1,161,831	1,641,276

LEAF TOBACCO EXPORTED TO THE UNITED STATES AND GUAM

Quarter	1937
	Kilograms
First	5,119
Second	2,400
Third	150
Fourth	13,422
Total	21,091

NOTE.—The figures of tobacco products exported to the United States, appearing under the heading of the Tobacco Promotion Work of the Bureau, differ from those indicated under the heading of Internal Revenue Taxes, inasmuch as the former represent actual exportation, whereas the latter merely removal from the manufacturing establishment.

"*Tobacco hearing by the Preparatory Committee on Philippine Affairs.*— Toward the latter part of August of 1937, the American members of the Joint-Preparatory Committee on Philippine Affairs appointed by the President of the United States arrived in Manila. On the fifteenth of the following month, they commenced to hold a series of hearings relative to the export trade of the Philippines with the United States. Previous to this hearing, a well-prepared brief about the tobacco industry was submitted to the Committee by the Manila Tobacco Association. The brief recites in detail the reciprocal tobacco trade between the United States and this country during the last ten years. It also contains facts and figures which tend to prove that the reciprocal tobacco trade was mutually beneficial to the two countries and not to the Philippines alone, and that, as a matter of fact, the balance of trade was in favor of the United States. The brief also indicates that the imposition of five per cent export tax on Philippine cigars in the sixth year of the transition period will adversely affect, if not destroy, the cigar industry in this country, and that therefore the same will likely cause poverty and misery to more than half a million Filipinos engaged in the industry because of the fact that more than 60 per cent of the cigars manufactured locally are exported to the United States. In conclusion, the brief recommends that the economic provisions of the Tydings-McDuffie Act be amended so as to exempt the Philippine Tobacco from paying the graduated export tax. To supplement the information contained in the brief, the President and some members of the Manila Tobacco Association appeared at the tobacco hearing of the Committee. The testimony and supplemental figures they presented to the

Committee highly impressed the members of the Committee. It may be mentioned that in the preparation of the brief submitted by the Manila Tobacco Association, this Bureau rendered its fullest coöperation by gathering valuable statistics about the domestic tobacco industry.

"*Compliance with the tobacco classification regulations.*—The classification and grading of leaf tobacco in the provinces were, as a whole, done by the tobacco dealers. The low price paid for the tobacco crop this year on account of the poor demand of the commodity abroad was so discouraging to the planters that they showed little interest in classifying leaf tobacco before selling it. As in previous years, the transactions between the buyers and the farmers were effected on the basis of weight and not on the quality of the leaf tobacco. This procedure is, of course, disadvantageous to the farmers, for the reason that under this method the buyers offer the price corresponding to the lowest grade of leaf tobacco contained in the lot, disregarding entirely the higher grade of leaf tobacco found in the lot. Had the farmers classified their tobacco properly, the buyers would have naturally offered a higher price for the higher grade of leaf tobacco. In view of the indifference of the farmers in classifying their 1937 crop, the tobacco inspectors of this Bureau were obliged to concentrate their efforts on the supervision of the buyers' establishments. On account of the low production of tobacco in 1937, and the refusal of several farmers to dispose of their tobacco crop during the buying season, the quantity of leaf tobacco that entered the said establishments during the year was comparatively smaller than that of 1936. It was, therefore, easy for the graders who were employed by the buyers to classify and pack the leaf tobacco properly. Hence, very few violations of the tobacco classification regulations were detected.

"The quantities of leaf tobacco inspected by this Bureau during 1937, as compared with those of 1936, are indicated in the following statement:

Place of inspection	1936		1937	
	Number of bales	Weight in kilos	Number of bales	Weight in kilos
Abra	412	16,100	98	3,200
Cagayan	6,605	756,595	9,938	1,106,640
Capiz	4	200	----------	----------
Cebu	27,333	1,350,890	11,501	548,900
Ilocos Norte	72	1,825	39	5,081
Ilocos Sur	238	12,670	121	5,995
Iloilo	17	800	445	14,600
Isabela	8,373	918,040	11,833	1,247,930
La Union	36,641	2,317,310	18,171	1,367,445
Leyte	12,644	620,550	3,739	186,900
Manila	115,471	11,358,574	169,735	14,572,026
Masbate	292	6,290	366	9,700
Mountain Province	2	50	----------	----------
Nueva Ecija	143	7,150	----------	----------
Nueva Vizcaya	21	975	951	28,768
Occidental Negros	6,193	180,650	2,859	97,725
Oriental Negros	4,420	118,025	1,434	40,800
Pangasinan	31,949	1,582,680	32,865	1,626,825
Romblon	1,068	53,400	79	3,900
Total	251,898	19,302,774	264,173	20,866,435

"*The leaf tobacco market.*—The leaf tobacco market in the Cagayan Valley during the year was dull in spite of the small crop harvested during the year which was estimated to be approximately 280,000 quintals (1 quintal = 46 kilos) or 100,000 quintals less than that harvested in 1936. The considerable decrease was due mainly to the destruction of a large portion of the seedbeds by the flood which swept the Cagayan Valley during the end of 1936. In anticipation of a rise in the price of the 1937 crop due to the low production, many tobacco farmers refused to dispose of their crops during the buying season so that at the end of the year, a considerable portion of the harvested crop still remained unsold. Tobacco planters who were in need of cash but who could not wait for the rise in price, were forced to sell their leaf tobacco during the buying season at a price ranging from ₱3.50 to ₱8 per quintal which was practically the same as that received by them for their crop in 1936, although it may be stated that the quality of the leaf tobacco harvested this year was somewhat inferior to that of last year. The unfavorable weather conditions that prevailed during the growing and curing seasons were responsible for the poor quality of the harvest.

"In the La Union-Pangasinan district, a substantial increase in the harvest was noted. From an estimated harvest of 150,000 quintals produced in 1936, the quantity harvested this year rose to approximately 200,000 quintals. The increase in the harvest was attributed mainly to the high price paid for last year's crop which encouraged the farmers to enlarge their acreage and partly to the favorable weather conditions which prevailed during the planting and growing seasons. The large increase in the harvest of the leaf tobacco proved unavailing to the farmers, because it depressed further the critical market situation in Manila where a large portion of the 1936 tobacco crop had been dumped unsold. As a consequence of the big supply of leaf tobacco, the price paid per quintal for the 1937 crop was approximately 40 per cent lower than that paid for the crop of the year previous.

"In the Manila market, the prices of leaf tobacco during 1937, as compared with those of the previous year were as follows:

Province of origin	Class	Leaf tobacco crops	Price per quintal	
			1936	1937
Isabela	1–5	Various	₱8.50 to ₱13.50	₱9.00 to ₱13.50
Cagayan	1–5	do	8.00 to 12.00	8.50 to 12.00
Pangasinan	1–5	do	7.50 to 10.00	6.50 to 9.50
La Union	1–5	do	7.50 to 11.00	7.00 to 10.00

"*The Philippine tobacco trade in China.*—A moderate reduction in the shipment of manufactured tobacco to China was registered during the year, although a slight increase was noted in the exportation of leaf and stripped and partially manufactured tobacco. For many years, now, our tobacco trade in that country has remained stationary on account of the high tariff and the civil strife going on in several sections of the country. In the latter part of 1937, the trade conditions in China showed a downward trend due to the Japanese occupation of the northern and central

parts of China. With current troubles in that country, the outcome of which is hard to predict, the sale of Philippine tobacco is expected to decline further.

"On December 3, 1937, there was paid from the Tobacco Inspection Fund the sum of ₱1,500 to cover attorney's fees in Shanghai, China for professional services rendered in the suppression of illegal activities in China of certain cigar manufacturers who, in order to deceive the public and lead the consumers to believe that the cigars and other manufactured tobacco products sold in Shanghai, China, were manufactured in Manila, falsified the tobacco strip stamps of the Government of the Philippines and affixed to boxes of cigars manufactured in Shanghai. As a result of the valuable services rendered by the attorneys contracted by the Government of the Philippines, no further attempt at falsification of the strip stamps affixed to boxes containing Manila cigars was made by the cigar manufacturers in China.

"The following comparative statement shows the quantity of the Philippine tobacco products exported to China during 1936 and 1937:

	Unit	1936	1937
Cigars	Number	6,468,208	6,150,835
Cigarettes	do	5,925,770	5,740,050
Leaf tobacco	Kilograms	366,632	368,919
Stripped and partially manufactured tobacco	do	66,551	72,127
Smoking and chewing tobacco	do	2,378	2,011

"*The Tobacco Board.*—The membership of the Tobacco Board during 1936 was as follows:

Mr. Alfredo L. Yatco, Collector of Internal Revenue, Ex Officio Chairman,

Mr. Hilarion S. Silayan, Director of Plant Industry, Member,

Mr. Cornelio Balmaceda, Director of Commerce, Member.

Dr. Manuel V. Gallego, Representative of the Manila Tobacco Association, Member,

Mr. Manuel Rivera Correa, Representative of the Manila Tobacco Association, Member,

Mr. Vicente T. Fernandez, Representative of the tobacco producers and growers, Member, and

Dr. Leon O. Manzanillo, Representative of the tobacco producers and growers, Member.

"Mr. Cornelio Balmaceda, who was appointed Acting Manager of the National Produce Exchange created by Commonwealth Act No. 192, was succeeded by Mr. Anastacio de Castro as Acting Director of the Bureau of Commerce beginning September 16, 1937. Doctor Gallego was also succeeded by Mr. Philip S. Frieder upon the recommendation of the Manila Tobacco Association. Mr. Manuel Rivera Correa was relieved by Mr. Adrian Got and in the absence of the latter, Mr. Antonio Rosales attended the meetings of the Tobacco Board. The Board held meetings on March 9, May 25, August 10, and November 18, 1937. A total allotment of ₱132,573 was set aside by the Board from the Tobacco Inspection Fund

to carry out its various activities, in accordance with Act No. 2613, as amended by Act No. 3179, but the Honorable, the Secretary of Finance approved only ₱128,988. This amount, in itemized form, was included in the General Appropriation Act for 1937.

"Among the important matters considered by the Tobacco Board was the construction of tobacco warehouses in the Cagayan Valley for the use of the farmers in storing their crops. The Board also considered the advisability of amending Regulations No. 47 of the Department of Finance which govern the classification and inspection of leaf tobacco, in accordance with Act No. 3179, but up to this time, the Board has made no definite decision on the matter.

"*Advertising work.*—The sum of ₱5,000 was allotted by the Tobacco Board from the Tobacco Inspection Fund during 1937 and spent for advertising Philippine cigars collectively in various tobacco trade journals published in the United States. This method of advertising has, in one way or another, indirectly aided in increasing the sale of Philippine cigars. As the allotment of ₱5,000 was found insufficient to carry on the advertising campaign for Philippine cigars in the United States, the Tobacco Board voted an additional sum of ₱5,000 from the Tobacco Inspection Fund for the same purpose. However, when the resolution of the Board was submitted to the Honorable, the Secretary of Finance, the latter disapproved the additional allotment on the ground that the 1937 Appropriation Act specifically provided that only ₱5,000 could be spent during the year for advertising purposes. To secure the needed amount, the Tobacco Board set aside the corresponding sum from the Advertising Fund created by Act No. 3424.

"For advertising the individual products of the factories exporting cigars to the United States, the Tobacco Board also allotted the sum of ₱22,575 from the special fund of ₱300,000 created by the above-mentioned Act. The total amount appropriated by the Tobacco Board from the said special fund since the passage of Act No. 3424 is ₱241,035.92 which has been allotted as follows: ₱31,432.62 in 1928; ₱41,781.32 in 1929; ₱28,680.72 in 1930; ₱39,239.59 in 1931; ₱11,140.60 in 1933; ₱21,180.52 in 1934; ₱27,095.54 in 1935; ₱25,117 in 1936; and ₱22,575 in 1937. No allotment for advertising was made in 1932.

"In the disposal of the 1937 allotment to advertise the individual products of the cigar factories in accordance with Act No. 3424, the Tobacco Board approved a plan which allowed the said factories a share of the allotment. The allowance given to each factory is based upon the number of cigars it exported during the previous year. According to the plan, Class "A" cigars weighing less than 13 pounds per thousand would be entitled to advertisement at the rate of ₱0.06 per thousand, while those weighing above 13 pounds and invoiced below $18, ₱0.12½ per thousand; those shipped at prices ranging from $18 to less than $25 per thousand, ₱0.20 per thousand; those from $25 and above per thousand, ₱0.40 per thousand; Class "B" cigars, ₱1 per thousand; and Classes "C", "D", and "E" cigars, ₱4 per thousand.

"The different media of advertising included in the plan are newspaper, magazine, trade journal and billboard advertising, daylight signs, window displays, boxlid covers, and window posters.

"*Advertising Fund and Tobacco Inspection Fund.*—The statements showing the financial status of the Advertising Fund and the Tobacco Inspection Fund as created by Act No. 3424 and Act No. 2613, as amended, respectively, are given hereunder:

ADVERTISING FUND UNDER ACT No. 3424

Appropriated by Act No. 3424			₱300,000.00
Less:			
Disbursements for advertising cigars of individual factories in accordance with the plans of the Tobacco Board:			
Expended during—			
1928	₱31,422.62		
1929	41,781.32		
1930	28,680.72		
1931	39,239.59		
1932	....		
1933	15,080.60		
1934	11,667.31		
1935	18,932.68		
1936	8,552.48		
1937	75.00	₱195,432.32	
Outstanding obligations for:			
1934	₱8,082.94		
1935	9,543.14		
1936	16,564.52		
1937	15,425.00	49,615.60	245,047.92
Unappropriated surplus, December 31, 1937			₱54,952.08

TOBACCO INSPECTION FUND

Balance on hand, January 1, 1937		₱263,153.21
Add:		
Savings from the funds under the Bureau of Plant Industry, etc.		7,599.26
		₱270,752.47
Add:		
Tobacco Inspection fees collected during 1937:		
Leaf tobacco	₱54,412.59	
Cigars	55,913.20	
Cigarettes	43.71	
Manufactured	24,722.01	135,081.51
Total amount available for 1937		₱405,843.98
Less:		
Disbursements during 1937:		
Tobacco industry section	₱34,628.65	
Tobacco agriculture developments	* 40,045.74	
Tobacco agents in the United States	26,509.29	
Advertising in the United States	5,000.00	
Advertising in the Philippines	489.50	
Tobacco cases in China	1,526.26	108,199.44
Balance on hand, December 31, 1937		₱297,644.54

* * * * * * *

FOREIGN TOBACCO IMPORT DUTIES

ADEN

All kinds, free.

* This represents the total allotment for 1937. The actual expenses have not yet been reported by the Bureau of Plant Industry.

AFGHANISTAN

Cigars and cigarettes—50 per cent ad valorem. Plus excise tax of 30 per cent ad valorem in Kabul and 15 per cent ad valorem in the provinces. A surtax of 10 per cent ad valorem is also imposed.

ALGERIA

Francs per kilo: cigars, 2,500; cigarettes, 2,500; others, 2,000. Surtax of 17 francs per kilo on cigars and cigarettes, and varying surtaxes are also imposed based on the selling price.

ARGENTINA

	Pesos	Cents
Cigars, Havana, in wooden boxes, including weight of boxes, per kilo	2	57.9
The same in cardboard boxes, including boxes	3	79.81
Cigars other than Havana in wooden boxes containing more than 100 cigars, including boxes	1	14
In cardboard boxes, including boxes	1	49
Cigarettes of all kinds	1	53.16

(NOTE.—Internal revenue duties levied in addition of 10 per cent ad valorem is also imposed as a surtax.

AUSTRALIA, COMMONWEALTH OF

Tobacco, unmanufactured, not elsewhere included, 8/6 per lb.

Tobacco, unmanufactured, entered to be locally manufactured into tobacco other than fine cut tobacco suitable for the manufacture of cigarettes—to be paid at the time of removal to the factory—(1) Unstemmed, 3/6 per lb. (2) Stemmed, or partly stemmed, or in strips, 4/– per lb.

Tobacco, unmanufactured, entered to be locally manufactured into cigarettes or into fine cut tobacco suitable for the manufacture of cigarettes—to be paid at the time of removal to the factory—(1) Unstemmed—5/2 per lb. (2) Stemmed, or partly stemmed, or in strips—5/8 per lb.

Tobacco, cut, not elsewhere included:—9/3 per lb.

Tobacco, manufactured, not elsewhere included, including the weight of tags, labels and other attachments—9/per lb.

Cigarettes, including weight of cards and mouthpieces contained in inside packages; fine cut tobacco, suitable for the manufacture of cigarettes .... 16/-per lb.

Tobacco, unmanufactured, entered to be locally manufactured into cigars—to be paid at the time of removal to the factory:

A—Unstemmed	2/-per lb.
B—Stemmed, or partly stemmed, or in strips	2/6-per lb.
Cigars, including the weight of bands and ribbons	18/-per lb.
Snuff	6/6 per lb.

Tobacco destroyed for the manufacture of sheepwash or other purposes, as prescribed by Departmental By-laws—free.

A primage duty of 10 per cent ad valorem is also imposed.

(NOTE.—Under Order No. 594 of Trade and Customs Orders, 1927, the following regulations have been issued by the Commonwealth Government respecting the method of weighing tobaccos, cigars and cigarettes—

Tobacco: shipments of 5 cases and over, 10 per cent. To be weighed to the ¼ lb. Shipments under 5 cases, not less than ½ case. Cigars: (A) Cases of 10,000 cigars packed in 20 boxes, each 500; 3 boxes to be weighed to ¼ oz. per box = 15 per cent; (B) cases of 10,000 cigars packed in 100 boxes, each 100, 4 boxes to be weighed to ¼ oz. per box = 4 per cent; (C) cases of 10,000 cigars packed in 200 boxes, each 50, 5 boxes to be weighed to ¼ oz. per box = 2½ per cent; (D) cases of 10,000 cigars packed in 400 boxes, each 25, 8 boxes to be weighed to ¼ oz. per box = 2 per cent; (E) small cigars packed in boxes and packets of 10 and 20—cigars to be placed on scale until 8 oz. is obtained and average number per ½ lb. thus ascertained accepted. Cigarettes to 4 oz. to be ascertained. Separate weighing for each 10 cases, and the average arrived at to be accepted for the whole shipment. For small shipments and mixed cases the number of cigarettes of each line contained therein to be weighed to 4 oz., and the weight determined accordingly for shipment. Duty is to be charged as under on the total quantity of tobacco, cigars, and cigarettes ascertained by the respective methods of weighing: Tobacco to the ¼ lb., fractions of over ¼ lb. in total weight for duty to be discarded. Cigars and cigarettes to the oz., disregarding fractions of an oz. on the total weight for duty.

AUSTRIA

		Kronen
Tobacco and tobacco manufactures of all kinds, per 100 kilos....		125 00
License duty in addition:		
For cigars	70	schillings for 1 kilogramme of taxable weight
For cigarettes and cigarette tobacco	100	schillings for 1 kilogramme of taxable weight
For other tobacco, raw or manufactured	30	schillings for 1 kilogramme of taxable weight

Tobacco may only be imported into Austria by special permission.

Duties, etc., are quoted in gold kronen, but are paid in schillings at the rate of 1.83 schillings to the gold krone.

BAHAMAS

		Per lb. s. d.
Unmanufactured	B.P.T. 1½d. per lb G.T.	3
Manufactured: Cigarettes	B.P.T., 25% ad val. G. T.	50% ad val.
Cigars		25% ad val.
Fine cut B.P.T., 25% ad val. G. T.		50% ad val.
All other manufactured tobacco B.P.S.-14½	G.T.	-/9

(NOTE.—A drawback of duty is allowed to the extent of 4½ d. for every 100 cigars manufactured in the Colony from imported duty-paid tobacco upon their exportation, provided that no drawback will be allowed unless

satisfactory security by bond is given for the due exportation of such cigars, and that they shall not be unshipped or relanded at any port within the Colony).

BARBADOS

	British preferential tariff Per lb. s.	d.
Unmanufactured-leaf stemmed	3	0
Leaf unstemmed	2	0
Manufactured—		
Cigars, cheroots, and cigarettes	6	0
Snuff	1	0
All other manufactured tobacco	3	0

NOTE.—A surtax of 10 per cent of the duty is also imposed.

BELGIUM

	Rates of duty per 100 kilos *Frs.*	*cts.*
Manufactured tobacco:		
Cigars and cigarettes	2,500	00
Tobacco, pipe (cut); chewing tobacco; snuff	1,000	00
Other, including tobacco extracts (praiss)	500	00
Tobacco, not manufactured—		
Not stemmed	500	00
Stalks and tobacco substitutes	500	00
Stemmed	900	00

Under article 2 of the Law foreign unmanufactured tobacco of any kind or quality is also subject to an excise duty of 100 francs per 100 kilogs., payable at the same time as the customs duty.

Consumption duties are also imposed:

A transmission tax of 5 per cent ad valorem is also levied.

BELGIAN CONGO

Manufactured tobacco of all kinds, viz., cigars, cigarettes, cut tobacco, smoking tobacco, snuff and all tobacco substitutes, 10 per cent ad valorem.

Tobacco in the leaf, of all kinds .... 18% ad valorem

Internal taxes are also levied.

BERMUDA

Tobacco dust, stems, or other tobacco refuse imported solely for use for agricultural or horticultural purposes .... Free

Unmanufactured:	
Unstemmed	6d. per lb.
Stemmed	1/6 per lb. (*b*)

NOTE.—A drawback of duty is not allowed on unmanufactured tobacco unless exported in its original condition.

Manufactured:	
Cigars	20/- per 1,000 (*c*) (*b*)
Cigarettes, B.P.T. 2/- per lb. (*b*) G. T.	3/- per 1,000 (*b*)
Snuff	9d per 1,000 (*b*)
All other manufactured tobacco, B.P.T.	1/-
G.T.	1/6 per 1,000 (*b*)

(*b*) With 10 per cent ad valorem, in addition.
(*c*) The importers have the option of paying duty at the rate of 2/- per lb.

A surtax of 22½ per cent of the duty is also levied, except in the case of foreign products which are liable to a surtax of 25 per cent of the duty.

BOLIVIA

Tobacco, in leaves or cut	1.50 bolivianos per kilog.
Tobacco for chewing	1.50 bolivianos per kilog.
Tobacco in powder	4.50 bolivianos per kilog.
Cigars of all kinds	8.50 bolivianos per 100
Cigarettes of all kinds	8.50 bolivianos per 1,000

Various surtaxes and a consular fee of 6 per cent ad valorem are also imposed.

BRAZIL

	Reis
Cigars, per 100	87,360
Cigarettes, per kilo	60,840
Tobacco in leaves of whatever origin or quality	12,480
Chewing and the like	29,120
Cut or in filaments for pipes or cigarettes	35,360
Snuff	70,720

Consumption duties are also levied on tobacco, etc. A surtax of 2 per cent ad valorem is also levied.

BRUNEI

Tobacco:	
Chinese	80 cents per katty.
Sumatra, Palembang or other native tobacco	80 cents per katty.
Cigars	80 cents per lb.
Cigarettes—	
British	80 cents per lb.
Foreign	90 cents per lb.
Other manufactured—	
British	80 cents per lb.
Foreign	90 cents per lb.

BULGARIA

Raw tobacco	350 levas per 100 kgs.
Manufactured tobacco:	
a. Cut	3,000 levas per 100 kgs.
b. Cigarettes	3,200 levas per 100 kgs.
c. Cigars	1,000 levas per 100 kgs.
d. Snuff and chewing tobacco	3,000 levas per 100 kgs.

The following additional taxes (excise and Octroi) are also levied.

Cut tobacco:	
a. Extra	70 leaves per 100 kgs.
b. 1st, 2nd, and 3rd quality	55 leaves per 100 kgs.
c. For the nargile	615 leaves per 100 kgs.
Cigarettes:	
a. Extra	80 leaves per 100 kgs.
b. 1st, 2nd, and 3rd quality	60 leaves per 100 kgs.
Cigars	340 leaves per 100 kgs.
Snuff and chewing tobacco	640 leaves per 100 kgs.
Raw tobacco (Octroi tax only)	20 per cent of import duty.

NOTE.—All the above duties are fixed on the gold basis. When paid in paper currency, a surtax is levied which is fixed periodically. At the present time the surtax is 27 times.

A revenue stamp tax of 3 per cent of the total charges is levied.

CANADA, DOMINION OF

Tobacco unmanufactured, for excise purposes, under conditions of the Inland Revenue Act, free. (The Inland Revenue Act, No. 51 of 1906 (sec. 330) (revised statutes) provides that all raw tobacco imported shall be bonded in a Customs warehouse. By Act No. 6 of August 22, 1914, which amends the Inland Revenue Act No. 51 of 1906 (revised statutes) the following excise duties are imposed:—On all foreign raw leaf tobacco taken out of the warehouse for manufacture in any cigar or tobacco manufactory, unstemmed, per lb., 40 cents; stemmed, per lb., 60 cents. The above excise duties are in all cases on the raw leaf; there are other and additional excise duties on tobacco when manufactured.)

Cut tobacco:	
B. P. T.	80 cents per lb.
G. T.	95 cents per lb.

Manufactured: Cigarettes (including the paper covering) B. P. T. 3.50 dols., and 25 per cent. ad val., G T. dols., 10 cents. with 25 per cent ad valorem in addition; cigars, including the weight of bands and ribbons, 3 dols., 90 cents, per lb. plus 25 per cent ad valorem. (It is stated in Appraisers Bulletin, No. 327, dated August 19, 1909, that in the case of *cigars* wrapped individually, first with tissue paper, then with the foil, and on this the cigar band placed, the weight of the bands only will be included with the weight of the cigars. As regards *cigarettes* fitted with paper mouthpieces, the weight of the paper mouthpieces will be included in the weight of the cigarettes for duty purposes).

All other manufactured tobacco, including snuff, per lb., B. P. T., 75 cents, G. T., 90 cents. (All manufactured tobacco cigars and cigarettes *imported* are required to have revenue stamps affixed on the packages when entered for consumption. The owner or importer is responsible for affixing and cancelling the stamps, and the work must be done whilst the goods are in the custody of the Customs (Customs Memo., 1339 B., dated September 1, 1905).

Excise taxes from 0.50 dollars to 10 dollars per 1,000 are levied on cigars imported into Canada.

An excise tax of 3 per cent of the duty-paid value under the G. T., except on goods amounting to less than 25 dollars, when imported by post.

A sales tax of 6 per cent on the F. O. B. value plus amount of duty is also levied.

CANARY ISLANDS

	Per kilo Pesetas
Tobacco leaf—	
From Cuba	1.08
Philippines	0.82
Virginia	0.54
Manufactured—Cuba	2.17
Philippines	1.63
Virginia	1.08

CEYLON	B. P. T. Per lb. Rupees	Cts.
Hooka	2	00
Unmanufactured	2	00
Manufactured—		
Cigars	4	00
Cigarettes:		
(1) Manufactured in the British Empire from Empire-grown tobacco—		
(a) Sold wholesale at not more than Rsll per lb. net	5	00
(b) Sold wholesale at more than Rsll per lb. net	6	00
(2) Manufactured in the British Empire from foreign tobacco—		
(a) Sold wholesale at not more than Rsll per lb. net	5	50
(b) Sold wholesale at more than Rsll per lb. net	6	50
(3) Manufactured in the British Empire from Empire-grown and foreign tobacco at rates intermediate between (1) and (2) above, according to the certified proportions of Empire and foreign leaf content.		
(4) Manufactured in foreign countries	7	00
All other	4	00
Snuff	3	00

The following excise taxes are applicable to tobacco and tobacco products and cigarette paper produced in or imported into Germany. The tax is payable by means of revenue stamps. Tobacco must be placed in completely closed packages, the nature and size of which is fixed by the Ministry of Finance. The retail price and the kind and quantity of the contents must be printed on each packet: and the retail price must be on each cigarette.

Class A refers to cigars and the rate of tax in gold marks per thousand varies from 9.20 marks for cigars retailing up to 4 pfennig each to 57.50 marks plus a surtax of 11.50 marks for 1,000 for each increase of 5 pfennigs by which the net retail price of each cigar exceeds 25 pfennigs.

The tax on cigarettes ranges from 7.50 gold mark to 67.50 gold marks per 1000, a surtax of 26 gold marks per 1000 being levied in respect of each 5 pfennigs by which the retail price exceeds 15 pf. each.

Fine cut tobacco pays from 3.00 to 10 gold maks per kilog. the surtax levied in respect of each 6 marks by which the retail price exceeds 18 marks per kilog. being fixed at 2 marks per kilog. The tax on smoking tobacco other than fine cut varies from 1.05 to 3.50 gold marks per kilog. the surtax being 0.35 mark per kilog. when the price exceeds 9 marks per kilog. Chewing tobacco pays from 3 to 7.50 per 1000 with a surtax of 2.50 marks per 1000 in respect of each 5 pfs., by which the net retail sale exceeds 15 pfs. each. The tax on snuff varies from 0.30 to 0.40 gold mark per kilog. with a surtax of 0.10 mark per kilog. for each mark or part thereof by which the net retail sale price exceeds 4 gold marks per kilog.

A turnover tax of 2 per cent of the duty paid value is also levied.

GIBRALTAR

	B. P. T. s.	d.
Cigarettes	1	0
With an additional duty per 100 cigarettes or part thereof of 5d.		
Unmanufactured tobacco	....	4
Other manufactured tobacco, including cigars and snuff	1	8

GOLD COAST

	s.	d.
Other: Unmanufactured per lb.	2	3
Cigars, per 100	10	0
Cigarettes:		
(1) Not exceeding 3 lb. per 1000 per 100	2	6
(2) Exceeding 3 lb. net per 1000 per 100	10	0
Other manufactured, or snuff	6	0

GREECE

Tobacco—

(*a*) Of whatever origin, in leaves	400 dr. per 100 kgs.
(*b*) For the nargileh (tombeki)	400 dr. per 100 kgs.
(*c*) Cut	600 dr. per 100 kgs.
(*d*) Snuff	600 dr. per 100 kgs.
(*e*) Cigarettes of all kinds	800 dr. per 100 kgs.
(*f*) Cigars	700 dr. per 100 kgs.

Consumption duties are levied in addition, varying according to the selling price of the tobacco.

Surtaxes amounting to 75 per cent of the duty are also imposed.

All duties, etc., are quoted in gold, but payable in paper currency equivalent (25 paper = 1 gold.)

Tobacco in the leaf, imported from abroad by an industrial concern or company manufacturing cigars in Greece and exclusively intended for the manufacture of such cigars in Greece, shall be exempt from import duties and other taxes leviable thereon.

Tobacco manufacturers are allowed to import free of all taxes cigarette paper, packing material and boxes for cigarettes and cigars of all kinds provided they are for re-export.

GUATEMALA

Tobacco:

Leaf and sifted	1.30 quetzals per kilog.
Prepared, for chewing and for pipe, including the weight of packing	1.50 quetzals per kilog.
Cigars, including the weight of packing	5.00 quetzals per kilog.
Cigarettes, in paper or straw	5.00 quetzals per kilog.

NOTE.—The above duties have to be paid at the full gold purity. A consular fee of 4 pe rcent is also imposed on importation.

GUERNSEY

	Per lb.	
Leaf tobacco:		
With stem	2	10½
Without stem	3	0½
Manufactured tobacco	3	11
Cigars	3	1
Cigarettes	4	5

BRITISH GUIANA

Unmanufactured—

Leaf containing more than 38 lb. of moisture in every 100 lb. weight thereof .... Prohibited

		British preferential tariff Dolls.	General tariff Dolls.
Tobacco manufacture—			
Cigars	per lb.	2.10	3.00
Cigarettes—			
1. Manufactured in the British Empire entirely from Empire-grown tobacco	per lb.		1.83
2. Manufactured in the British Empire entirely from foreign tobacco	per lb.		2.20
3. Manufactured in foreign countries	per lb.		3.00

Provided that with respect to cigarettes manufactured in the British Empire which contain a blend of Empire and foreign tobacco the duty thereon shall be at a rate proportional to the percentage of each tobacco, the percentage of Empire and foreign grown tobacco being charged respectively the rates under (1) and (2) above.

Other, manufactured, and snuff—		
1. As (1) above	per lb.	1.18
2. As (2) above	per lb.	1.55
3. As (3) above	per lb.	2.60

Provided that with respect to tobacco and snuff manufactured in the British Empire which contains a blend of Empire and foreign tobacco the duty thereon shall be at a rate proportional to the percentage of each tobacco, the percentage of Empire and foreign grown tobacco being charged respectively the rates under (1) and (2).

In leaf—		
If in packages containing not less than 400 lbs.		
(*a*) Containing not less than 25 lbs. and not more than 38 lbs. of moisture in every 100 lbs. weight thereof per lb.	0.50	0.60
(*b*) Containing less than 25 lbs. of moisture in every 100 lbs. weight thereof per lb.	0.86	0.96

If in packages containing less than 400 lbs.

(*a*) As above	per lb.	0.60	0.70
(*b*) As above	per lb.	0.96	1.06

(An additional 30% on the amount of duty leviable at the rate given is also levied).

A surtax of 3 per cent ad valorem is also imposed.

HOLLAND

Tobacco:

In rolls, leaves, and unpressed stems	1.40 florins per 100 kgs.
Pressed stems	5.00 florins per 100 kgs.
Cut, snuff, carrots, and all other manufactured tobacco	30 per cent ad valorem
Cigars	30 per cent ad valorem
With a minimum charge of	15 florins per 1000
Cigarettes	45 per cent ad valorem

Excise duties are also imposed.

HONDURAS, BRITISH

		British preferential tariff. Dolls.	General tariff Dolls.
Tobacco and snuff:			
Unmanufactured, leaf	per lb.	0.30–0.45	0.50–0.75
Manufactured—			
Cigars	per lb.	0.60	0.80
Cigarettes	per lb.	2.00	2.50
Snuff	per lb.	0.50	1.00
Other manufactured tobacco	per lb.	0.75	1.50

HONG KONG

Manufactured tobacco:

	Duty Dollars per lb.
1. Cigars—	
(*a*) Of Empire origin and manufacture	1.60
(*b*) Of Empire manufacture only	1.80
(*c*) Other	2.00
2. Cigarettes—	
(*a*) Of Empire origin and manufacture	0.80
(*b*) Of Empire manufacture only	0.90
(*c*) Other	1.00
3. Other manufactured tobacco, including snuff and cigar cuttings—	
(*a*) Of Empire origin and manufacture	0.80
(*b*) Of Empire manufacture only	0.90
(*c*) Other tobacco, etc.	1.00
(*d*) Chinese prepared tobacco	0.90

HUNGARY

Tobacco and tobacco manufacture of all kinds, by special permission only	125 korona per 100 kgs.
The following license charges are also levied.	
Cigars and cigarettes	72 korona per kilog.
Other manufactured tobacco	58 korona per kilog.

NOTE.—Duties are quoted in gold kronen but are payable in pengo at the rate of 8.63 gold kronen to 10 gold pengo.

A turnover tax of 3 per cent ad valorem is also imposed.

ICELAND

	Kron.	
Tobacco, smoking, chewing or manufactured, per kilo	6	00
Unmanufactured	6	00
Cigars and cigarettes, including weight of paper, boxes, or tins	16	00

BRITISH INDIA

Tobacco, unmanufactured, per lb.	B. P. T. 2r. 12a. G. T. 3r. 4a.
Manufactured, per lb.	112½ per cent ad valorem.
Other kinds, per lb.	3r. 12a.

Cigarettes 25% ad valorem and in addition either 8r. 2a. per 1,000 or 3r. 4a. per lb., whichever is higher.

IRAQ

Cigarettes	750 fils per kilog.
Cigars	100 per cent ad valorem
Manufactured tobacco, other	500 fils per kilog.
"Tumbaki"	300 fils per kilog.
Snuff	500 fils per kilog.
Smoking and chewing tobacco	750 fils per kilog.

IRISH FREE STATE

	General			Pref.
Tobacco:				
Unmanufactured—				
If stripped or stemmed—				
Containing 10 lb. or more of moisture in every 100 lb. weight thereof	0	10	0 1/2	
Containing less than 10 lb. of moisture in every 100 lb. weight thereof	0	11	1 1/2	
If unstripped or unstemmed—				
Containing 10 lb. or more of moisture in every 100 lb. weight thereof	0	10	0	
Containing less than 10 lb. of moisture in every 100 lb. weight thereof	0	11	1	
Manufactured, viz.:				
Cigars	0	19	1	5/6th of full rate
Cigarettes	0	15	5	5/6th of full rate
Cavendish or negrohead	0	14	7	5/6th of full rate
Cavendish or negrohead, manufactured in bond	0	12	8	5/6th of full rate
Other manufactured tobacco	0	12	8	5/6th of full rate
Snuff containing more than 13 lb. of moisture in every 100 lb. weight thereof	0	12	0	5/6th of full rate
Snuff not containing more than 13 lb. of moisture in every 100 lb. weight thereof	0	14	7	5/6th of full rate

ITALY

Tobacco:

Raw:

2. Leaf	Free
2. Stem	Free
3. Other, and tobacco substitutes	Free

The import of raw tobacco to reserve to the state.

Manufactured:		Paper Lire	
1. Cigarettes	kilog.	477	00
2. Cigars, Manila and Havana and other superior qualities	kilog.	477	00
3. Cigars, common	kilog.	257	00
4. Cut "chiari dolci" and Cuban	kilog.	367	00
5. Cut, other	kilog.	220	00
6. Snuff	kilog.	183.5	00
7. Other	kilog.	183.5	00

Additional taxes amount to 15½$ ad valorem are levied.

The importation of manufactured tobacco is reserved to the State.

Manufactured tobacco may, however, be imported for the personal use of the importer in a quantity not exceeding 4 kilogs. through customs houses of the first class, and through those of the second order of the first class; and not exceeding 2 kilogs. through other customs houses. For the importation of quantities exceeding 4 kilogs., permission of the Minister of Finance is necessary.

Manufactured tobacco imported on account of the State is admitted free of duty.

ISLE OF MAN

		B. P. T.	
Tobacco:			
Manufactured—			
(*a*) Cigarettes	14/7 per lb.	11/5	1/4
(*b*) Cigars	18/1 per lb.	14/2	1/4
(*c*) Cavendish or negrohead	13/9 per lb.	10/9	3/8
(*d*) Cavendish or negrohead, manufactured in bond	12/– per lb.	9/4	7/8
(*e*) Other manufactured tobacco	12/– per lb.	9/4	7/8
Snuff containing more than 13 lb. of moisture in every 100 lb. weight thereof	11/4 per lb.	8/10	5/8
Snuff containing less than 13 lb. of moisture in every 100 lb. weight thereof	13/9 per lb.	10/9	3/8
Tobacco, unmanufactured:			
Containing 10 lb. or more of moisture in every 100 lb. weight thereof—			
(*a*) Unstripped or unstemmed	9/6 per lb.	7/5	1/2
(*b*) Stripped or stemmed	9/6 per lb.	7/5	7/8
Containing less than 10 lb. of moisture in every 100 lb. weight thereof—			
(*a*) Unstripped or unstemmed	10/6 per lb.	8/2	7/8
(*b*) Stripped or stemmed	10/6 1/2 per lb.	8/3	1/4

JAMAICA

NOTE.—The following are preferential duties	s.	d.
Unmanufactured leaf, per lb.	2	6
Manufactured:		
Cigarettes—		
1. Manufactured within the British Empire containing not less than 50 per cent of British Empire tobacco (the weight of the cigarettes to include the paper covering) per lb.	9	0
2. Manufactured within the British Empire and containing less than 50 per cent of British Empire tobacco (the weight of the cigarettes to include the paper covering) per lb.	10	0
3. Cigarettes, not otherwise proved for (the weight of the cigarettes to include the paper covering) per lb.	12	0
Cigars, per lb.	10	0
All other manufactured tobacco, per lb.	4	0
Snuff, per lb.	3	6

JAPAN

Cigars, cigarettes, and cut tobacco .... 355 per cent ad valorem.

JERSEY

Unmanufactured tobacco:		
Leaf with stalks	1	7
Leaf without stalks	2	8
Manufactured tobacco (except cigars and cigarettes)	2	8
Cigars and cigarettes	3	9

Drawback is not allowed on stalks of tobacco. The difference of 1s. 1d. per pound on unmanufactured tobacco without stalks is virtually a prohibition against the importation of raw tobacco in the form of "strips."

KENYA, UGANDA AND TANGANYIKA

	Sh.	Cts.
Tobacco and manufactures thereof:		
Cigars, cheroots and cigarillos, per lb.	5	00
or 62½ per cent ad valorem whichever is the greater		
Cigarettes, per lb.	2	65
or 62½ per cent ad valorem, whichever is the greater		
Snuff, per lb.	1	50
Tobacco, manufactured, not specially mentioned, per lb.	2	65
or 62½ per cent ad valorem, whichever is the greater		
Tobacco, unmanufactured, per lb.	1	0

In Kenya and Uganda a wharfage due of 1 per cent of the duty paid value is levied.

LABUAN

	Dols.	Cts.
Tobacco, imported in tins, per lb.	1	10
Cigars, per lb.	1	60
Cigarettes, per lb.	1	10
Other tobacco	0	80

LEEWARD ISLANDS

St. Christopher and Nevis.

Tobacco and snuff:	
Unmanufactured:	
Leaf—	
British pref. tariff	10d. per lb.
General	1/2 per lb.
Manufactured:	
(*a*) Cigars of over the value of 6/– per 100	
British preferential tariff	5/6 per lb.
General	7/– per lb.
(b) Cigars, of and under the value of 6/– per 100	
British preferential tariff	4/2 per lb.
General	5/– per lb.
(*c*) Cigarettes	
British preferential tariff	4/2 per lb.
General	5/– per lb.
(*d*) Snuff	
British preferential tariff	3/9 per lb.
General	5/– per lb.
(*e*) Other manufactured tobacco	
British preferential tariff	4/2 per lb.
General	5/– per lb.

A surtax of 25 per cent of the duties is also imposed.

Antigua.

Tobacco and snuff:	
Unmanufactured:	
Leaf—	
British preferential tariff	1/– per lb.
General	1/6 per lb.
Manufactured:	
(*a*) Cigars if of less value than 6/– per 100	
British preferential tariff	4/2 per lb.
General	6/3 per lb.
(*b*) Cigars if of 6/– per 100 or over that value	
British preferential tariff	7/6 per lb.
General	10/– per lb.
(*c*) Cigarettes	
British preferential tariff	6/3 per lb.
General	8/4 per lb.
(*d*) Snuff	
British preferential tariff	6/3 per lb.
General	8/4 per lb.
(*e*) Other manufactured tobacco	
British preferential tariff	5/– per lb.
General tariff	7/6 per lb.

A surtax of 20 per cent of the duties is also levied.

Dominica.

Tobacco and snuff:

	British preferential tariff.
Unmanufactured:	
(*a*) Leaf—	
1. In packages of less than 200 lbs.	2/6 per lb.
2. In other packages	1/6 per lb.
Manufactured:	
(*b*) Cigars	6/– per lb.
(*c*) Cigarettes	5/6 per lb.
(*d*) Snuff	3/– per lb.
(*e*) Other manufactured tobacco	4/– per lb.

NOTE.—A surtax of 15 per cent of the duties is also levied.

LIBERIA

	Dols.
Manufactured, per lb.	0.12
Cigars, per 100	1.60
Cigarettes, per 100	0.15
Leaf, per lb.	0.12

LITHUANIA (including MEMEL)

	Lits per kg.
Tobacco:	
In leaf	1.50
Cut, ground as snuff and all kinds of rolled tobacco	50.00
Cigarettes	60.00
Cigars	75.00

The following excise duties are also levied.

Raw tobacco—No excise duty.

Manufactured tobacco—45 per cent of retail selling price fixed by the seller and approved by the Taxes Department of the Ministry of Finance.

Cigars—20 per cent as above.

Cigarettes with or without mouthpiece—45 per cent as above.

LUXEMBURG

Belgian duties apply in Luxemburg

MALTA

	s.	d.
Cigars (not including wrapper), per kilog	11	0
Cigarettes (not including wrapper), per kilog	15	0
Cavendish or negrohead per kilog	5	0
Other manufactured tobacco, per kilog	5	0
Snuff, per kilog	3	9
Unmanufactured tobacco	3	9

MAURITIUS

	Per lb.
Unmanufactured—	
Grown or produced in any of the Dependencies of Mauritius	Free
All other unmanufactured—	
Butted or stemmed	13.50
Not butted or stemmed	12.50

Manufactured—	
Cigars, cigarettes, and snuff	16.50
Grown or produced in any of the Dependencies of Mauritius	7.50
Other kinds	15.00

MEXICO

	Pesos per kilo.
Cut tobacco	3.60
Snuff	4.80
Cigarettes	5.00
Cigars (puros)	10.00

Imported cigarettes, cigars, and tobacco, cut, or chewing and snuff are subject in addition to Customs duty, to an internal tax which is payable by the fixing of stamps to each box or packet, etc., before the goods leave the Customhouse. Surtax of 3 per cent of the duties are levied.

Cigarettes: sifted cut, chopped and chewing tobacco and snuff of national production pay a stamp tax of 40 per cent of the cost of manufacture or its equivalent.

Cigars pay 20 per cent; cigarettes 60 per cent.

Foreign manufactured tobacco similar to above, pay double the above rates.

MONACO

The duties leviable in France are applicable to this principality.

MONTENEGRO

The duties in force in Jugoslavia on tobacco are applicable to this territory.

MOROCCO

Tobacco, manufactured and unmanufactured 17½ per cent ad valorem and in addition—

Cigars	54 francs per 100.
Cigarettes	90 francs per 1,000.
Cut and smoking tobacco	90 francs per kilo.

NETHERLANDS EAST INDIES

Tobacco:

Tobacco and snuff	12.00 florins per 100 kg.
Cigars	100.00 florins per 100 kg.
Cigarettes	150.00 florins per 100 kg.

A surtax of 50 per cent of the duties is also imposed.

NEWFOUNDLAND

	Dols.	Cts.
Cigars per lb.	3	70
Cigarettes, per lb.	4	50
Snuff	0	80
Other manufactured tobacco (plus 18 per cent ad valorem)	0	41
Tobacco, manufactured, commonly used in making cigarettes or both pipe and cigarette smoking	1	03

	Dols.	Cts.
Leaf stripped or partly manufactured (plus 18 per cent ad valorem)	0	55
Leaf unstemmed, 8 per cent ad valorem plus	0	55
Leaf and stems when imported by licensed manufacturers, in bond		Free
Leaf stripped when imported by licensed manufacturers, in bond		Free

NEW HEBRIDES

Tobacco, cigars and cigarettes	50 per cent ad valorem

NEW ZEALAND, DOMINION OF

Cigarettes, not elsewhere included	25/6
Cigarettes exceeding in weight 2½ lb. per 1,000	10/6
Cigars, including the weight of every band, wrapper or attachment, to any cigar, per lb.	12/–
Snuff, per lb.	12/–
Tobacco, cut, not elsewhere included, per lb.	6/10
Tobacco, not elsewhere enumerated, including the weight of every label, tag, or other attachment,, per lb.	6/8

A surtax of 5 per cent of the duty payable is also levied on foreign goods.

NIGERIA

Unmanufactured, per lb.	2	0
Manufactured: Cigars per 1,000	8	0
Cigarettes—		
(1) Exceeding 1½ lbs. but not exceeding 3 lbs. per 1,000 2/– per 100.		
(2) Not exceeding 1½ lbs. and exceeding 3 lbs. per 1,000 8/– per lb.		
All other manufactured tobacco, including snuff	4	0

NYASALAND PROTECTORATE

Unmanufactured tobacco, per lb.	1	6
Manufactured tobacco, cigars, per lb.	5	3
Cigarettes, per lb.	7	9
Cigars	5	3

NORWAY

	Per kilo kron	ore
Snuff	3	80
Cigars and cigarettes	6	00
All other manufactured tobacco	2	70
Unmanufactured—		
Stalks and in the leaf, seasoned or not, and carrots	2	25
Praiss	0	55

NOTE.—A surtax of 83.6 per cent of duty is also levied. Stamp duties are levied in addition.

PALESTINE

Uncut tobacco, P. T. 40 per kilog.
Manufactured tobacco and chewing tobacco, P. T. 75 per kilog.
Cigars, P. T. 200 per kilog.
Snuff, P. T. 60 per kilog.
Tombac, P. T. 60 per kilog.
An additional duty of P. T. 5 per kilog. on all imported tobacco products is levied on behalf of municipalities.
Cigarettes, P. T. 100 per kilog.

PAPUA

Unmanufactured not elsewhere included	3/6 per lb.
Manufactured, not elsewhere included, including the weight of tags, labels and other attachments	4/8 per lb.
Trade tobacco of which 29 sticks or figs weigh in the aggregate not less than 1-lb. avoirdupois	1/9 per lb.
Cigars, including the weight of bands or ribbons	10/– per lb.
Cigarettes, including the weight of cards or mouthpieces contained in inside packages	10/6 per lb.

A surtax of 4 per cent ad valorem is also imposed.

PARAGUAY

Cigars of all kinds	30 pesos per 1000
Cigarettes	3 pesos per 1000
Tobacco, other manufactures	0.60 peso per kilog.

Surtaxes of 30 per cent of the duties 2 per cent ad valorem and 1½ ad valorem are also imposed.

PERSIA

Cigars and cigarettes	60% ad valorem
Other manufactured tobacco	50% ad valorem

PERU (Government monopoly)

		Dols.	Cts.
Manufactured tobacco	per kilo	1	00
Manufactured into common cigars (Italian or Swiss)	per kilo	4	00
Other cigars	per kilo	3	50
Cigarettes	per kilo	2	25

Surtaxes amounting to 20 per cent of duties also levied, and, surtax of 3 per cent ad valorem.

PHILIPPINES

		Dols.
Leaf tobacco, unstemmed	per kilo	4.08
Leaf tobacco, stemmed	per kilo	5.52
Cigars, cigarettes, and cheroots of all kinds, and 25 per cent ad valorem	per kilo	9.93
Other tobacco, manufactured	per kilo	1.25

or the rates of duty imposed on similar products imported into U. S. A., whichever shall be the greater.

POLAND

Tobacco and manufactures thereof:

1. Tobacco in the leaf or in bundles with or without the stalks; tobacco stalks waste and dust	2,000.00 zlotys per 100 kgs
2. Snuff	4,000.00 zlotys per 100 kgs
3. Tobacco in rolls or carrots	5,000.00 zlotys per 100 kgs
4. Cigars and cigarillos	7,500.00 zlotys per 100 kgs
5. Cut tobacco:	
Over 1 mm.	5,000.00 zlotys per 100 kgs
Up to 1 mm.	7,000.00 zlotys per 100 kgs
6. Cigarettes	7,500.00 zlotys per 100 kgs

NOTE.—A manipulation tax of 10 per cent of the duty is also imposed.

PORTUGAL

Duties are quoted in gold.

		Escudos
Unmanufactured tobacco		1.40
Manufactured:		
Cut	per kilo	3.61'6
Cigarettes		3.83'8
Cigars		4.15'4

NOTE.—Stamp duties are levied in addition.

Duties are quoted in gold (value, 53⅓ pence each), but payment must be made in paper. The rates of conversion are as follows:

1 gold escudo = 24.45 paper escudos.
110 paper escudos = $1.

PORTUGUESE COLONIES

Province of Mozambique. East Africa.

Unmanufactured tobacco imported by factories for manipulation shall be subject to a tax of 5 per cent *ad valorem* but the amount imported is a quantity fixed annually by the Director of Customs Department for each factory.

Tobacco:	
In the leaf or roll	3.00 escudos per kilog.
Made up in any other manner	223.00 escudos per kilog.

Manica and Sofala (including Beira) (The Mozambique Company Territory).

Tobacco:	
(*a*) In leaves, rolls or paste	2.00 escudos per kilog.
(*b*) Cigars and cigarettes	7.03 escudos per kilog.
(*c*) Manufactures, not specially mentioned	4.00 escudos per kilog.

WEST AFRICA

Angola.

Leaf, moist or plug tobacco	18.00 escudos per kilog.
Cigars	90.00 escudos per kilog.
Cigarettes	90.00 escudos per kilog.

NOTE.—Consumption taxes are also levied as follows:

Cigars	24.00 escudos per kilog.
Cigarettes	19.20 escudos per kilog.
Other	14.40 escudos per kilog.

RHODESIA

	s.	d.
Tobacco—		
Unmanufactured	3	6
Manufactured—		
Cigars and cigarillos	8	6
and in addition, 15 per cent ad valorem.		
Goorak, or gooracco mixture, etc.	6	0
and in addition, 15 per cent ad valorem.		

(NOTE.—Under the Southern Rhodesia "Cigarette Excise and Surtax Ordinance, 1914," No. 9 of 1914, and the Northern Rhodesia Government notice No. 38 of 1915 as amended, provision is made for the imposition of an excise duty on *cigarettes* manufactured in Rhodesia as well as of a corresponding *additional customs duty* on cigarettes imported for consumption therein at the rate of 1 d. per ½ oz. net weight fraction thereof.)

	s.	d.
Snuff	4	0
Other manufactured	5	0

The following excise taxes are also levied:

Manufactured tobacco—	per s.	lb. d.
(*a*) Ready for smoking in a tobacco pipe including cake, plug and stick tobacco	....	6
(*b*) Ready for use in the making of cigarettes	....	6
(*c*) In the form of cigarettes, including the weight of the outer portion of each cigarette	....	6
(*d*) In the form of cigars or cigarrillos	1	0
(*e*) In the form of roll tobacco	....	2

RUMANIA

Tobacco in the leaf and prepared tobacco in every form prohibited.

NOTE.—Tobacco for personal use can only be imported with special permission from the Monopoly Administration and on payment of the taxes fixed by them.

SARAWAK

Manufactured tobacco:	
Chinese	70.00 dls. per picul
Other	100.00 dls. per picul
In tins	1.00 dl. per lb.
Cigars	1.50 dls. per lb.
Cigarettes, including wrappers and filter tips, not exceeding 2½ lbs. net per 1,000	2.50 dls. per 1,000
Cigarettes, including wrappers and filter tips, exceeding 2½ lbs. but not exceeding 2¾ lbs. per 1,000	2.75 dls. per 1,000
Cigarettes, including wrappers and filter tips, exceeding 2¾ but not exceeding 3 lbs. per 1,000	3.00 dls. per 1,000
Cigarettes, including wrappers and filter tips, exceeding 3 lbs. per 1,000	1.10 dls. per lb.

ST. HELENA

	s.	*d.*
Unmanufactured, per lb.	1	0
Manufactured	4	0
Cigars, per lb.	7	6
Cigarettes	5	0

JUGOSLAVIA

SERB–CROAT–SLOVENE KINGDOM

Tobacco in leaf or refuse	Free
	Gold dinars.
On cigarettes	600 per kilog.
On cigars	500 per kilog.
On cut tobacco	300 per kilog.
On snuff	200 per kilog.

11 paper dinars = 1 gold dinar.

In addition to duties, the following monopoly taxes are levied:

250 paper dinars per 1 kg. of cut tobacco.

160 paper dinars per 100 cigarettes.

10 paper dinars per 1 cigar.

SEYCHELLES

Tobacco—	
Unmanufactured:	
B. P. T.	4.50 rupees per kilo.
G. T.	7.50 rupees per kilo.
Cigars—	
Manufactured:	
B. P. T.	6.50 rupees per kilo.
G. T.	9.50 rupees per kilo.

Cigarettes—

(*a*) Not exceeding a weight of 85 grammes (3 ozs.) per 100—

(1) Manufactured in the British Empire from Empire-grown tobacco .... per 100 0.55

(2) Manufactured in the British Empire from foreign tobacco	per 100	0.69
(3) Manufactured in foreign countries	per 100	0.83
(*b*) Exceeding a weight of 85 grammes (3 ozs.) per 100—		
(1) As (1) above	per kilo.	6.50
(2) As (2) above	per kilo.	8.13
(3) As (3) above	per kilo.	9.74
Other manufactured tobacco and snuff—		
(1) As (1) above	per kilo.	6.50
(2) As (2) above	per kilo.	8.50
(3) As (3) above	per kilo.	9.50

NOTE.—A surtax of 10 per cent of the duties is also levied.

SIERRA LEONE

	British preferential tariff. s.	d.
Unmanufactured, per lb.	1	2
Cigars per lb.	6	6
Cigarettes:		
1. Not exceeding a weight of 4¼ ozs. per 100:		
(*a*) Manufactured in the British Empire from Empire-grown tobacco ... per 100	1	6
(*b*) Manufactured in the British Empire from foreign tobacco ... per 100	2	0
(*c*) Manufactured in foreign countries	2	6
2. Exceeding a weight of 4¼ ozs. per 100:		
(*a*) As (*a*) above ... per 100	6	0
(*b*) As (*b*) above ... per 100	8	0
(*c*) As (*c*) above ... per 100	10	0
Other manufactured tobacco:		
(1) Manufactured in the British Empire from Empire-grown tobacco ... per lb.	4	0
(2) Manufactured in the British Empire from foreign tobacco ... per lb.	5	0
(3) Manufactured in foreign countries ... per lb.	6	0
Snuff ... per lb.	5	0

UNION OF SOUTH AFRICA

Tobacco unmanufactured, per lb., 3s. 6d.; cigars and cigarillos, per lb., 9s. 4d. Goorak (gooracco) and hookah mixture, and all imitations or substitutes thereof, or for tobacco, per lb., 6s. cigarettes per lb., 8s. Snuff, per lb., 4s. Other, per lb., 5s.

(NOTE.—An excise duty on *cigarettes* manufactured in the Union, as well as corresponding additional Customs duty on cigarettes imported for consumption within the Union of South Africa, at the rate of ¾d. for every ½ oz. net weight or fraction thereof is levied). On all cigarettes tobacco a surtax of 1½d. per 2 ozs. or fraction thereof is also imposed.

SPAIN

The Monopoly duties are as follows:		Pesos	Cts.
Cigars in bulk	per kilog.	48	00
Cigars in boxes	per kilog.	48	00

		Pesos	Cts.
Cigarettes	per kilog.	30	00
Cut tobacco	per kilog.	30	00

When duties are paid other than in gold a surcharge is levied fixed every ten days. This is published in Board of Trade Journal.

NOTE.—(1) The Tobacco Monopoly Company is alone authorized to clear through the Customs tobacco destined for private persons on compliance with certain formalities. The company charges by way of commission, and in addition to the Monopoly duties, 12 per cent, on the original value (value at factory) of cigars plus the amount representing the Monopoly duty, and 25 per cent, in the case of cigarettes or cut tobacco.

(2) Manufactured tobacco (cigars, cigarettes, and cut tobacco) is dutiable, together with the weight of all the interior packages or receptacles in which presented to the Customs, whatever be the quantity, quality, or nature thereof, but exclusive of the weight of the outside case or receptacle enclosing other containers.

(3) Cigarettes and cut tobacco imported in bulk in rough receptacles are dutiable after deducting the weight of such receptacles used to transport them.

(4) Cigarettes or cut tobacco wrapped only in tobacco leaf are regarded as cigars, while those rolled in paper even with an outside wrapper of leaf tobacco are regarded as cigarettes.

STRAITS SETTLEMENTS (OTHER THAN LABUAN)	B. P. T.	
Cigars and snuff, per lb.	$1	60
Cigarettes, per lb. B. P. T. 1.00 S. T.	1	10
Unmanufactured tobacco	0	70
Other manufactured tobacco:		
1. If imported for sale to the public in airtight tins or containers, per lb.	$1	0
2. Other, per lb.	0	80

SUDAN

	Per kilog. Milliemes
Tobacco, in leaf	1000
Tobacco in leaf, stripped of its "petiole" or middle fibre	1000
Manufactured—	
Cigars, whatever their quality	1000
Cigarettes	1000
Other manufactured, cut or powdered	1000

A quay due of 1 per cent ad valorem is also levied.

SWEDEN

Tobacco and tobacco products—free of duties.

NOTE.—Tobacco products may only be imported subject to special regulations.

SWITZERLAND

	Swiss francs per 100 kilogs.
Cut cigarette tobacco not packed for retail sale	3,000
Cut cigarette tobacco packed for retail sale	2,000

	Swiss francs per 100 kilos
Cut pipe tobacco, not packed for retail sale	1,000
Cut pipe tobacco, in metal packages, for retail sale	750
Cut pipe tobacco, packed for retail sale otherwise than in metal	850
Cigars not packed for retail sale	1,600
Cigars packed for retail sale	1,200
Cigarettes not packed for retail sale	3,000
Cigarettes packed for retail sale—	
Weighing up to 1'35 grammes each	1,800
Others	2,300

TAHITI

Import duty—15 per cent ad valorem.

In addition an import tax of 6 per cent of invoice value is also imposed.

Octroi duties—

1. Tobacco and snuff	500 francs for 100 kilos.
2. Cigars and cigarettes	1,000 francs for 100 kilos.

Consumption—

1. As above	4 francs per kilo.
2. As above	8 francs per kilo.

TANGANYIKA (see Kenya)

TRINIDAD

	British preferential tariff. s.	d.
(*a*) Leaf containing 25 per cent or more of moisture when dried at a temperature of 212 degrees Fahrenheit	3	3
(*b*) Leaf containing less than 25 per cent of moisture .. per lb.	4	9
(*c*) Cigars per lb.	7	6
Cigarettes—		
1. Manufactured in the British Empire entirely from Empire-grown tobaccos per lb.	8	10
2. Manufactured in the British Empire entirely from foreign-grown tobaccos per lb.	10	6
Provided that a further preference shall be granted of 1d. for each 5 per cent of Empire-grown tobacco used in blends of British and foreign-grown tobaccos.		
3. Manufactured in foreign countries per lb.	13	0
Other manufactured tobacco—		
1. Manufactured in the Empire, entirely from Empire-grown tobaccos per lb.	6	7
2. Manufactured in the Empire, entirely from foreign-grown tobaccos per lb.	8	3
Provided that a further preference shall be granted of 1d. for each 5 per cent Empire-grown tobacco used in blends of Empire and foreign grown tobaccos.		
3. Manufactured in foreign countries per lb.	10	8
(*d*) Snuff		

A surtax of 10 per cent of the duty is also levied.

TURKEY

Tobacco—	
In leaf	150 Turkish £ per 100 kgs.
Cut or chopped	1800 Turkish £ per 100 kgs.
Chewing and snuff tobacco	2000 Turkish £ per 100 kgs.
Cigars—	
Rolled leaf	200 per cent ad valorem
Cigars and cigarettes manufactured (even partially) from chopped or cut tobacco	2000 Turkish £ per 100 kgs.

A transaction tax of 10 per cent of the duty paid value is also levied. A surtax of 10 per cent of the duty is imposed.

UGANDA (see Kenya)

URUGUAY

		Pesos	Cts.
Cigarettes in packets (including receptacles)	per kilo	2	50
Cigarettes of Havana tobacco wherever manufactured (including receptacles)		3	50
Cigarettes of black tobacco (including the tin box)		2	50
Cigars of any kind, loose or in packets (including receptacles)		1	00

In addition, a surtax of 14 per cent *ad valorem* is levied on cigars, and one of 9 per cent *ad valorem* on cigarettes. Internal taxes are also levied.

UNITED STATES OF AMERICA

Wrapper tobacco, and filler tobacco when mixed or packed with more than 35 per cent of wrapper tobacco, and all leaf tobacco the product of two or more countries or dependencies when mixed or packed together, if unstemmed, 2 dols. 27½ per pound; if stemmed, 2 dols. 92½ per pound; filler tobacco, not specially provided for, if unstemmed, 35 cents per pound; if stemmed, 50 cents per pound.

The term "wrapper tobacco" as used in this title means that quality of leaf tobacco which has the requisite color, texture, and burn, and is of sufficient size for cigar wrappers and the term "filler tobacco" means all other leaf tobacco. Collectors of customs shall permit entry to be made, under rules and regulations to be prescribed by the Secretary of the Treasury of any leaf tobacco when the invoices of the same shall specify in detail the character of such tobacco, whether wrapper or filler, its origin and quality. In the examination for classification of any imported leaf tobacco, at least 1 bale, box, or package in every ten, and at least 1 in every invoice, shall be examined by the appraiser or person authorized by law to make such examination, and at least 10 hands shall be examined in each examined bale, box or package.

All other tobacco, manufactured or unmanufactured, not specially provided for, 55 cents per pound; scrap tobacco, 35 cents per pound.

Snuff and snuff flour, manufactured of tobacco, ground dry, or damp, and pickled, scented, or otherwise, of all descriptions, and tobacco stems, cut, ground, or pulverized, 55 cents per pound.

Cigars, cigarettes, cheroots of all kinds, 4 dols. 50 per pound and 25 per cent *ad valorem*, and paper cigars and cigarettes, including wrappers, shall be subject to the same duties as are herein imposed upon cigars.

The internal revenue taxes imposed upon cigars and cigarettes manufactured in or imported into the United States are as follows:

	Additional tax (payable by the importer or manufacturer) per 1,000 Dols.	cts.
On cigars of all descriptions made of tobacco or any substitute therefor, weighing not more than 3 lbs. per 1,000	0	75
Weighing more than 3 lbs. per 1,000 if manufactured or imported to retail at not more than 5 cents each	2	00
More than 5 cents and not more than 8 cents each	3	00
More than 8 cents and not more than 15 cents each	5	00
More than 15 cents and not more than 20 cents each	10	50
More than 20 cents each	13	50
On cigarettes made of tobacco or any substitute therefor, weighing not more than 3 lbs. per 1,000	3	00
Weighing more than 3 lbs. per 1,000	7	20
Tobacco or snuff manufactured or imported and sold or removed for consumption or sale per lb.	0	18

Special provisions are laid down as to the quantities and manner in which cigars, cigarettes, manufactured tobacco, and snuff may be packed.

The taxes (payable by the manufacturer or importer on *cigarette papers* made up into packages, books, sets, or tubes, made up in or imported into the United States are practically the same as those imposed by the Revenue Act of October 3, 1917, and are at the following rates: Packages, books, or sets containing more than 25 but not more than 50, ½ cent each. More than 50 but not more than 100, 1 cent each; more than 100, ½ cent for each 50 papers or part thereof; tubes, 1 cent for each 50 tubes or part thereof.

VENEZUELA

Cigars and cigarettes; tobacco—15 bolivares per kilo. Also an internal tax on cigarettes of 5 bolivares per kilo.

Surtaxes amounting to 56.55 per cent of the ordinary duty are also levied.

VIRGIN ISLANDS

Tobacco and snuff:	B.P.T.		G. T.	
Unmanufactured in the leaf per lb.	0	6	0	9
Manufactured:				
Cigars if over 6/- per 100	3	0	4	6
Cigars if of or under 6/- per 100	2	0	3	0
Cigarettes	1	4	2	0
Snuff	1	6	2	3
Others	1	6	2	3

NOTE.—A surtax of 2 per cent of the duties is also imposed.

ZANZIBAR PROTECTORATE

		Rupees
Cigars, cheroots and cigarillos	per lb.	2.00
(or 40 per cent ad valorem whichever is greater.)		
Manufactured tobacco	per lb.	1.00
(or 40 per cent ad valorem whichever is greater.)		
Cigarettes	per lb.	1.75
(ad valorem alternative duty not applicable.)		

PART V. SOME IMPORTANT LAWS AND REGULATIONS AFFECTING THE TOBACCO INDUSTRY

There are three Philippine and one United States laws which are of great importance to Philippine tobacco manufacture and manufacturers, to wit: (1) Internal Revenue Law (Chapter 40, Administrative Code, 1917); (2) The Tobacco Inspection Law; (3) The Cigars and Cigarettes Trade-Mark Law, (4) The Revenue Act of 1921 of the United States (Title VII, Tax on Cigars, Tobacco and Manufactures Thereof). The last is important to the Philippines because of the existing free trade between the United States and the Philippines. This, among other things, allows the free entry of Philippine cigars, tobacco and manufactures thereof into the United States, the internal-revenue regulations of the latter country notwithstanding, being applicable to Philippine cigars, leaf tobacco and manufactures thereof when thus exported to the United States.

For the purpose of this paper, only excerpts of the Philippine Internal Revenue Law and the Revenue Act of 1921 of the United States (Title VII) will be quoted, but the Cigars and Cigarettes Trade-Mark Law (Act No. 3202), and the Tobacco Inspection Law (Act No. 2613, as amended) will be given in full.

EXCERPTS FROM THE PHILIPPINE INTERNAL REVENUE LAW

(Chapter 40, Administrative Code, 1917 as amended by Commonwealth Act No. 466)

ARTICLE V.—*Privilege taxes*

SEC. 1464. (As amended by section 3, Act 2835, and section 1, Act No. 2925.) *Amount of tax on business.*—Fixed taxes on business shall be collected as follows, the amount stated being for the whole year, when not otherwise specified:

(*d*) Manufacturers of tobacco, twenty pesos.
(*e*) Manufacturers of cigars, twenty pesos.
(*l*) Tobacco dealers, eight pesos.
(*m*) Retail leaf tobacco dealers, thirty pesos.
(*n*) Wholesale peddlers of manufactured tobacco, eighty pesos.
(*o*) Retail peddlers of manufactured tobacco, sixteen pesos.

SEC. 1465. (As amended by section 4, Act No. 2835). *Words and phrases defined.*—In applying the provisions of the preceding section words and phrases shall be taken in the sense and extension indicated below:

(*d*) "Manufacturer of tobacco" includes every person whose business it is to manufacture tobacco or snuff, or who employs others to manufac-

ture tobacco or snuff, whether such manufacture is by cutting, pressing, grinding, or rubbing, any raw or leaf tobacco, or otherwise preparing raw or leaf tobacco or manufactured or partially manufactured tobacco and snuff, or putting up for consumption scraps, refuse, or stems of tobacco resulting from any process of handling tobacco, or by working or preparing leaf tobacco, tobacco stems, scraps, clipping, or waste by sifting, twisting, screening, or by any other process.

(*e*) "Manufacturer of cigars" includes those whose business it is to make or manufacture cigars or cigarettes for sale, but the terms do not include artisans or apprentices employed to make cigars or cigarettes from material supplied by the employer, the latter being lawfully engaged in the manufacture of cigars or cigarettes.

(*l*) "Tobacco dealer" comprehends every person who for himself or on commission sells or offers for sale cigars, cigarettes, or manufactured tobacco.

(*m*) "Retail leaf tobacco dealers" includes every person who for himself or on commission sells leaf tobacco or offers the same for sale to any person except a registered dealer in leaf tobacco or a manufacturer of cigars, cigarettes, or manufactured tobacco; but the term does not include a planter or producer so far as concerns the sale of leaf tobacco of his own production.

(*n*) "Peddler" means any person who either for himself or on commission travels from place into town or country and sells his goods or offers to sell and deliver the same. Whether a peddler is a wholesale peddler or a retail peddler of a particular commodity shall be determined from the definitions of wholesale dealer and retail dealer, as above given in connection with the particular commodity peddled. A wholesale peddler of manufactured tobacco is one who sells for the purpose of resale.

ARTICLE VI.—*Specific taxes*

SEC. 1478. *Articles subject to specific tax.*—Specific internal-revenue taxes apply to things manufactured or produced in the Philippine Islands for domestic sale or consumption and to things imported from the United States or foreign countries, but not to any thing produced or manufactured here which shall be removed for exportation and is actually exported without returning to the Islands, whether so exported in its original state or as an ingredient or part of any manufactured article or product.

In case of importation the internal-revenue tax shall be in addition to the customs duties, if any.

NOTE.—On all tobacco products exported, no specific tax will be collected, but such tobacco products exported to countries other than the United States must be subjected to the merchants' percentage tax. (See B. I. R. Ruling No. 13 (July 12, 1921), 22 Off. Gaz., 46, cited also under section 1459, *ante*.)

SEC. 1490. *Specific tax on products of tobacco.*—On manufactured products of tobacco, except cigars, and tobacco specially prepared for chewing so as to be unsuitable for consumption in any other manner, but including all other tobacco twisted by hand or reduced to a condition to be consumed in any manner other than by the ordinary mode of drying and curing; and on all tobacco prepared or partially prepared for sale or consumption, even if prepared without the use of any machine or instrument and without

being pressed or sweetened; and on all fine-cut shorts and refuse, scraps, clippings, cuttings, and sweepings of tobacco, there shall be collected, on each kilogram, sixty centavos.

On tobacco specially prepared for chewing so as to be unsuitable for use in any other manner, on each kilogram, forty-eight centavos.

SEC. 1491. (As amended by Act No. 2733.) *Removal of tobacco products without prepayment of tax.*—Products of tobacco entirely for chewing or smoking may be removed free of tax for agricultural or industrial use, under such conditions as may be prescribed in the regulations of the Bureau; and stemmed leaf tobacco, fine-cut shorts, the refuse of fine-cut chewing tobacco, refuse, scraps, cuttings, clippings, and sweepings of tobacco may be sold in bulk as raw material by one manufacturer directly to another, under such conditions as may be prescribed by regulations of the Bureau, without the prepayment of tax.

"Stemmed leaf tobacco," as herein used, means leaf tobacco which has had the stem or midrib removed. The stem does not include broken leaf tobacco.

SEC. 1492. (As amended by section 3, Act. No. 2733, and section 6, Act No. 2835.) *Specific tax on cigars and cigarettes.*—On cigars and cigarettes (except hand-made cigars and cigarettes prepared by the consumer for his own consumption and so used) there shall be collected the following taxes:

(*a*) Cigars—

1. When the manufacturer's or importer's wholesale price, less the amount of the tax, is thirty pesos per thousand or less, on each thousand, two pesos and thirty centavos.
2. When the manufacturer's or importer's wholesale price, less the amount of the tax, is more than thirty pesos but not more than sixty pesos per thousand, on each thousand, four pesos and sixty centavos.
3. When the manufacturer's or importer's wholesale price, less the amount of the tax, exceeds sixty pesos per thousand, on each thousand, seven pesos.

(*b*) Cigarettes—

1. When the manufacturer's or importer's wholesale price, less the amount of the tax, is four pesos or less per thousand, on each thousand, one peso and thirty centavos.
2. When the manufacturer's or importer's wholesale price, less the amount of the tax, is more than four pesos but not more than six pesos per thousand, on each thousand, three pesos.
3. When the manufacturer's or importer's wholesale price, less the tax, exceeds six pesos per thousand, on each thousand, four pesos.

The maximum price at which the various classes of cigars and cigarettes are sold at wholesale in the factory or in the establishment of the importer to any member of the public shall determine the rate of the tax applicable to such cigars; and if the manufacturer or importer also sells, or allows to be sold, his cigars and cigarettes at wholesale in another establishment of which he is the owner or in the profits of which he has an interest, the

maximum sale price in such establishment shall determine the rate of the tax applicable to the cigars and cigarettes therein sold.

Every manufacturer or importer of cigars and cigarettes shall file with the Collector of Internal Revenue, on the date or dates designated by the latter, a sworn statement of the maximum wholesale prices of cigars and cigarettes, and it shall be unlawful to sell said cigars and cigarettes at wholesale at a price in excess of the one specified in the statement required by this law without previous written notice to said Collector of Internal Revenue.

1. Where a manufacturer has sold cigarettes at wholesale at his storeroom to any who might apply in reasonable wholesale quantities at ₱4 per thousand, the fact that the larger part of the cigarettes manufactured by him were purchased by his son at ₱4 per thousand and sold him at wholesale with cigarettes of other manufacture for more than such price did not make the "wholesale price or value" of the manufacturer's cigarettes more than ₱4 per thousand. (See Epremiam v. Ward, 169 Fed. 691, 693.)
2. A is a manufacturer of cigars and cigarettes. Outside of his factory he establishes stores in which he sells his cigars and cigarettes. Each of said stores is debited, at the time the cigars and cigarettes are removed from the factory, with the regular price of the same plus internal-revenue duty. At the time the cigars and cigarettes are removed from the factory the duty is paid by the manufacturer and the same is added to the regular price of the cigars and cigarettes. The stores are debited at the regular price of the cigars and cigarettes, i. e., the price at which the same are sold to the trade generally. The cigars and cigarettes are sold in the stores either at wholesale or retail. Held, that the manufacturer is required to pay the internal-revenue duty on the basis of the regular price at the factory and not upon the basis of the price received in said stores. (La Germinal *vs.* Powell (1920), 41 Phil., 913.)

ARTICLE XII.—*Administrative provisions relative to persons and establishments subject to privilege taxes.*

SEC. 1551. *Sign to be exhibited by manufacturer of products of tobacco.*—Every manufacturer of cigars, cigarettes, or tobacco, and every wholesale dealer in leaf tobacco or manufactured products of tobacco shall place and keep on the outside of the building wherein his business is carried on, so that it can be distinctly seen, a sign stating his full business name in letters not less than six centimeters high and also giving his assessment in figures.

ARTICLE XIII.—*Administrative provisions regulating business of persons dealing in articles subject to specific tax.*

SEC. 1553. *Extent of supervision over establishments producing taxable output.*—The Bureau of Internal Revenue has authority to supervise establishments where articles subject to a specific tax are made and to prescribe regulations as to the mode in which the process of production shall be

conducted in so far as may be necessary to secure a sanitary output and to safeguard the revenue.

SEC. 1554. *Records to be kept by manufacturers—Assessments based thereon.*—The Collector of Internal Revenue is authorized to prescribe, by regulation, the records which shall be kept by manufacturers of articles subject to specific tax, and such records, whether of raw materials received into the factory or of articles produced therein, shall be deemed public and official documents for all purposes.

The records of raw materials kept by such manufacturers may be used as a species of evidence by which to determine the amount of specific taxes due from them, and whenever the amount of raw materials received into any factory exceeds the amount of manufactured or partially manufactured products on hand and lawfully removed from the factory, plus waste removed or destroyed, and a reasonable allowance for unavoidable loss in manufacture, the Collector of Internal Revenue may assess and collect the tax due on the products which should have been produced from the excess.

SEC. 1555. *Premises subject to approval by Collector.*—No person shall engage in business as a manufacturer of articles subject to a specific tax unless the premises upon which the business is to be conducted shall have been approved by the Collector of Internal Revenue.

SEC. 1556. *Labels and form of packages prescribed by Collector*—All articles of domestic manufacture subject to a specific tax and all leaf tobacco shall be put up and prepared by the manufacturer or producer, when removed for sale or consumption, in such packages only and bearing such marks or brands as shall be prescribed in the Bureau regulations; and goods of similar character imported into the Islands shall likewise be packed and marked in such manner as may be required.

SEC. 1557. *Removal of articles after payment of tax.*—When the tax has been paid on articles or products subject to a specific tax the same shall not thereafter be stored or permitted to remain in the distillery, distillery warehouse, bonded warehouse, or other factory or place where produced.

SEC. 1558. *Storage of goods in internal-revenue bonded warehouse.*—An internal-revenue bonded warehouse may be maintained in the City of Manila for the storing of imported or manufactured goods which are subject to a specific tax. The taxes on such goods shall be payable only upon removal from such warehouse, and a reasonable charge shall be made for their storage therein. The Collector of Internal Revenue may, in his discretion, exact a bond to secure the payment of the tax on any goods so stored.

1. The execution of a warehouse bond under this section is not a release of the liability of the sureties to a bond given under section 1560, post. (See U. S. *vs.* National Surety Co. (C. C. A. 1903) 122 Fed. 904, cited also under section 1560, post.)
2. As to when the specific tax upon imported goods stored in a bonded warehouse becomes due and collectible, see Asiatic Petroleum Co. *vs.* Rafferty (1918), 38 Phil. 475, 479, cited under section 1480 ante.

SEC. 1559. *Proof of exportation-Exporter's bond.*—Exporters of goods that would be subject to a specific tax if sold or removed from consumption in the Philippine Islands shall submit proof of exportation satisfactory to the Collector of Internal Revenue, and when the same is deemed necessary, shall be required to give a bond prior to the removal of the goods for shipment, conditioned for the exportation of the same in good faith.

SEC. 1560. *Manufacturer's and importer's bonds.*—Manufacturers and importers of articles subject to a specific tax shall give bond in an amount equal, as nearly as can be estimated, to twenty per centum of the taxes payable by them during an average year. Such bond shall be conditioned for the faithful compliance, during the time such business is followed, with the laws and regulations relating to such business and for the payment of all taxes lawfully accruing in respect to the goods manufactured or imported, as well as for the satisfaction of all fines and penalties imposed by the Internal Revenue Law. No such bond shall be required in a sum less than two hundred pesos.

SEC. 1561. *Records to be kept by wholesale dealers.*—Wholesale dealers shall keep records of their purchase and sales or deliveries of articles subject to a specific tax, in such form as shall be prescribed in the Bureau regulations. These records and the entire stock of goods subject to tax shall be open at all times to the inspection of internal-revenue officers.

SEC. 1562. *Records to be kept by dealers in leaf tobacco.*—Dealers in leaf tobacco shall keep records of the product sold or delivered by them to other persons in such manner as may be prescribed in the regulations of the Bureau of Internal Revenue, such records to be at all times open to the inspection of internal-revenue officers.

SEC. 1563. *Preservation of invoices and stamps.*—All dealers whosoever shall preserve all official invoices received by them from manufacturers, together with the fractional parts of stamps affixed thereto, and upon demand shall deliver or transmit the same to any internal-revenue officer.

SEC. 1571. *Authority of officer in searching for taxable article.*—Any officer or agent of internal revenue may in the discharge of his official duties enter any house, building, or place where articles subject to an internal-revenue tax are produced or kept, or are believed by him upon reasonable grounds to be produced or kept, so far as may be necessary to examine or discover the same.

The annotations included in the above excerpts are taken from the Internal Revenue Law, Annotated by B. L. Meer, law clerk of the Bureau of Internal Revenue, and published by The Lawyers Coöperative Publishing Company of Manila in 1925. (Mr. Meer is now Collector of Internal Revenue).

THE TOBACCO INSPECTION LAW

[Act No. 2613, as amended]

AN ACT TO IMPROVE THE METHOD OF PRODUCTION AND THE QUALITY OF TOBACCO IN THE PHILIPPINES AND TO DEVELOP THE EXPORT TRADE THEREIN.

By authority of the United States, be it enacted by the Philippine Legislature, that:

SECTION 1. It is hereby provided that the Bureau of Agriculture, through its agents or inspectors established in the tobacco provinces, shall period-

ically order, whenever it shall become necessary, the purchase of seeds of well-developed tobacco plants. The seeds purchased as prescribed in this Act shall be passed through a cleaning machine, with which each provincial agricultural station shall be provided, and, when cleaned, shall be distributed gratuitously by the inspecting agents of the Bureau of Agriculture proportionately among the tobacco planters.

SEC. 2. (As amended by Acts Nos. 2713 and 2737.) It shall be unlawful for any tobacco planter or other person who has in his possession uncured or incompletely cured leaf tobacco, to cure, dry, ferment, or treat same in any other manner, otherwise than in a building or curing shed constructed in accordance with the specifications of the Bureau of Agriculture: *Provided,* That this provision shall not apply to those who produce tobacco on a small scale: *And provided, further,* That on recommendation of the Director of Agriculture, the Secretary of Agriculture and Natural Resources may, by administrative order, exempt the tobacco planters of any municipality from the compliance with the provisions of this section until January first, nineteen hundred and nineteen, if it can be shown that it was impossible for the planters of said municipality to comply with said provisions on account of the distance of their properties from the public forests or for other good cause shown. Until December thirty-first, nineteen hundred and twenty-three, the Director of Forestry shall issue to any producer of tobacco a gratuitous license to cut timber of the first group for the construction of warehouses exclusive for the curing of tobacco.

SEC. 3 (As amended by Act No. 3179.) The Director of Agriculture is hereby authorized to appoint in any tobacco province the necessary inspectors to carry out the purposes of this Act. Said inspectors need not necessarily be residents of the province where they are to serve; but must be graduates of an agricultural school recognized by the Government, preference to be given to eligibles under the Civil Service rules who have specialized in tobacco-growing in an experimental farm or have at least one year's experience. In the absence of eligibles under the Civil Service rules, temporary employees may be appointed. Their salaries shall be fixed in their appointments and shall be subject to the Civil Service rules. Said tobacco inspectors shall receive a per diem not greater than two pesos when they are performing inspections outside of the municipality of their official station, together with actual and necessary traveling expenses.

SEC. 4. For the purpose of stimulating the production of the best tobacco among planters the Director of Agriculture may classify planters as first-class and second-class planters, and may grant diplomas to planters or producers for excellence in the production of tobacco.

SEC. 5. The Collector of Internal Revenue is empowered by this Act to announce contests for the purpose of discovering some remedy against tobacco pests and may grant from the fund known as tobacco inspection fund the amount which he considers necessary to reward the discoverer of a remedy which in his opinion proves to be the most efficient of those offered in the contest.

SEC. 6. The Collector of Internal Revenue shall have the power and it shall be his duty:

(*a*) To establish general and local rules respecting the classification, marking, and packing of tobacco for domestic sale or for

exportation to the United States so far as may be necessary to secure leaf tobacco of good quality and to secure its handling under sanitary conditions, and to the end that leaf tobacco be not mixed, packed, and marked as of the same quality when it is not of the same class and origin.

(*b*) To establish from time to time adequate rules defining the standard and the type of leaf and manufactured tobacco which may be exported to the United States, as well also as the manner in which standard tobacco for export, whether it be leaf tobacco or manufactured tobacco, shall be packed. Before establishing the rules above specified, the Collector of Internal Revenue shall give due notice of the proposed rules or amendments to those interested and shall give them an opportunity to present their objection to such rules or amendments.

(*c*) To require, whenever it shall be deemed expedient, the inspection of and the affixture of inspection labels to tobacco removed from the province of its origin to another or other provinces before such removal.

SEC. 7. No leaf or manufactured tobacco shall be exported from the Philippine Islands to the United States until it shall have been inspected by the Collector of Internal Revenue or his duly authorized representative and found to be the standard for export. Collectors of Customs shall not permit the exportation of tobacco from the Philippine Islands unless the shipment be in conformity with the requirements set forth in this Act. The prohibition contained in this section shall not apply to waste and refuse of tobacco accumulated in the manufacturing process when it is invoiced and marked as such waste and refuse.

SEC. 8. For inspections made in accordance with this Act there shall be collected a fee of thirty centavos for each thousand cigars or fraction thereof in the lot offered for inspection; three centavos for each thousand cigarettes or fraction thereof in the lot offered for inspection; twenty-five centavos for each one hundred kilograms of leaf tobacco in the lot offered for inspection.

SEC. 9. (As amended by Act No. 3179.) The Collector of Internal Revenue may appoint inspectors of tobacco for the purpose of making the inspection herein required, and may also detail any officer or employee of the Bureau to perform such duty. Said inspectors or employees shall likewise be charged with the duty of grading leaf tobacco and shall perform such other duties as may be required of them in the promotion of the Philippine tobacco industry. The Collector of Internal Revenue shall likewise appoint, with the approval of the Secretary of Finance, agents in the United States for the purpose of promoting the export trade in tobacco within the United States, whose duty it shall be to inspect shipments of tobacco upon or after their arrival in that country when so required, to assist manufacturers of, exporters of, and dealers in tobacco in disseminating information regarding Philippine tobacco and, at the request of the parties, to act as arbitrator between the exporter in the Philippine Islands and the importer in the United States whenever a dispute arises between

them as to quality, sizes, classes, or shapes shipped or received. When acting as arbitrator as aforesaid, the agent shall proceed in accordance with the law governing arbitration and award in the locality where the dispute arises. All agents, inspectors, and employees acting under and by virtue of this Act shall be subject to all penal provisions applicable to internal-revenue officers generally.

SEC. 10. Whenever cigars and cigarettes bearing the standard inspection label hereinbefore required shall arrive in the United States in a worm-eaten, musty, or moldy condition, or shall become worm-eaten within sixty days after arrival, the United States agent hereinbefore provided for shall inspect same at the request of the importer or dealer and cause them to be reconditioned, if practicable; if not, and the importer or dealer so desires, they shall be returned to the Philippine Islands. Expenses incurred in reconditioning such cigars in the United States or in transporting them back to the Philippine Islands from the place to which consigned when they left the Philippine Islands shall be borne by the Insular Government.

SEC. 11. In order to facilitate the free entry of tobacco products from the Philippine Islands into the United States, the Collector of Internal Revenue is authorized to act as stamp agent for the United States Commissioner of Internal Revenue, and to certify to the Insular Collector of Customs that the standard tobacco exported is the growth and product of the Philippine Islands. The Insular Collector of Customs, upon certificate from the Collector of Internal Revenue as aforesaid, shall issue such certificate of origin as may be necessary to insure the speedy admission of the standard tobacco into the United States free of customs duties. No such certificate shall be issued for tobacco which has not been inspected and labeled as provided for in this Act.

SEC. 12. (As amended by Act No. 3179.) The inspection fees collected by virtue of the provisions of this Act shall constitute a special fund to be known as the Tobacco Inspection Fund, with the approval of the Secretary of Finance, upon allotment by a board consisting of the Collector of Internal Revenue, the Director of Agriculture, the Director of the Bureau of Commerce and Industry, two manufacturers designated by the Manila Tobacco Association and two persons representing the interests of the tobacco producers and growers, appointed by the Governor-General. The Collector of Internal Revenue shall be ex officio chairman of the board, which shall have a secretary elected by the members thereof and compensated at a rate determined by the board with the approval of the Secretary of Finance.

These funds may be expended for any of the following purposes:

(*a*) The payment of the expenses incident to the enforcement of this Act including the salaries of the inspectors and agents.

(*b*) The payment of expenses incident to the reconditioning and returning to the Philippine Islands of damaged tobacco and the reimbursement of the value of the United States internal-revenue stamps lost thereby.

(*c*) The advertising of Philippine tobacco products in the United States and in foreign countries.

(*d*) The establishment of tobacco warehouses in the Philippine Islands and in the United States at such points as the trade conditions may demand.

(*e*) The payment of bounties to encourage the production of leaf tobacco of high quality.

(*f*) The promotion and defense of the Philippine tobacco interests in the United States and in foreign countries.

(*g*) The establishment, operation, and maintenance of tobacco experimental farms for the purpose of studying and testing the best methods for the improvement of the leaves: *Provided, however,* that thirty per centum of the total annual income of the tobacco inspection fund shall be expended for the establishment, operation, and maintenance of said tobacco experimental farms and for the investigation and discovery of efficacious ways and means for the extermination and control of the pests and diseases of tobacco: *Provided, further,* That in the establishment of experimental farms. preference shall be given to municipalities offering the necessary suitable land for the establishment of an experimental farm.

(*h*) The sending of special agents and commissions to study the markets of the United States and in foreign countries with regard to the Philippine cigars and their propaganda in said markets.

(*i*) The organization of exhibits of cigars and other Philippine tobacco products in the United States and in foreign countries.

SEC. 13. The Collector of Internal Revenue shall be the executive officer charged with the enforcement of the provisions of this Act and of the regulations issued in accordance therewith but it shall be the duty of the Director of Agriculture with the approval of the Secretary of Public Instruction, to execute and enforce the provisions hereof referring to the cultivation of tobacco.

SEC. 14. Any person who shall export or attempt to export from the Philippine Islands to the United States any tobacco that does not bear the inspection label hereinbefore required, and any person who shall knowingly violate any other provisions of this Act, or any of the rules issued by the Collector of Internal Revenue in accordance with this Act shall be punished by a fine not exceeding five hundred pesos or by imprisonment not exceeding six months, or by both penalties, in the discretion of the court.

SEC. 15. There is hereby appropriated out of any funds in the Insular Treasury not otherwise appropriated the sum of fifteen thousand pesos, which sum shall be made a part of the tobacco inspection fund hereinbefore created, and which shall be expended for the purposes and in the manner set forth in the expenditure of said fund.

SEC. 16. This Act shall take effect upon its passage: *Provided,* That any penal provisions contained herein for infractions of the provisions of this Act or of the regulations prescribed by the Collector of Internal Revenue shall not be enforced until the first day of July, nineteen hundred and sixteen.

Enacted, February 4, 1916.

CIGARS AND CIGARETTES TRADE-MARK LAW

[ACT NO. 3202]

AN ACT MAKING OBLIGATORY THE REGISTRATIONS OF TRADE-MARKS AND TRADE-NAMES FOR CIGARS AND CIGARETTES REQUIRING THE PUBLICATION OF APPLICATIONS FOR REGISTRATION OF SUCH TRADE-MARKS AND TRADE-NAMES, AND FOR OTHER PURPOSES.

Be it enacted by the Senate and House of Representatives of the Philippines in Legislature assembled and by the authority of the same:

SECTION 1. With the exception of trade-marks and trade-names already registered under the provisions of Act Numbered Six hundred and sixty-six, as amended, no trade-mark or trade-names shall be used on cigars or cigarettes in the Philippine Islands without having first been registered in the Bureau of Commerce and Industry, in accordance with the provisions of this Act and upon compliance with the requisites, as regards the application prescribed in the Trade-Mark Law, Act Numbered Six hundred and sixty-six, as amended.

Registration of such trade-names shall be conclusive evidence of the exclusive right of the persons using such trade-marks or trade-names, and in order to justify recovery of damages for infringement of such trade-marks or trade-names, as provided by Act Numbered Six hundred and sixty-six, as amended, it shall be sufficient to show that such trade-marks or trade-names were duly registered under the provisions of this Act: *Provided,* That the benefits of this provision shall be applicable to trade-marks and trade-names for cigars and cigarettes registered before this Act took effect.

SEC. 2. Upon filing an application for the registration of trade-marks or trade-names for cigars and cigarettes in accordance with the requirements hereinbefore prescribed, the Director of the Bureau of Commerce and Industry shall cause an examination of the trade-mark or trade name to be made, and if on such examination it shall appear that the applicant is entitled to registration of his trade-mark or trade-name, the Director of the Bureau of Commerce and Industry shall cause the said application to be published once a week for six consecutive weeks in the Official Gazette, the cost of publication to be defrayed by the applicant. Likewise the applicant shall notify the Manila Tobacco Association and other similar associations of the existence of such application, in order that any cigar or cigarette manufacturer considering himself entitled to object thereto may do so. The registration fee for trade-marks and trade-names for cigars or cigarettes shall be fifty pesos for each, except in the case of factories the capital of which does not exceed two thousand pesos, for which fees shall be twenty-five pesos each: *Provided,* That in the case application for registration is denied, the applicant shall pay only ten pesos for the examination, in addition to the expenses incurred for publication and notification.

SEC. 3. Any person who believes that his interests or rights would be prejudiced by the registration of a trade-mark or trade-name used on cigars or cigarettes, may oppose the same by filing notice of oposition stating the grounds therefor with the Bureau of Commerce and Industry

within fifteen days after the last publication of the application. Said notice of opposition shall be duly sworn to. If no notice of opposition is filed within the time prescribed by this section, the Director of the Bureau of Commerce and Industry shall issue a certificate of registration of the trade-mark or trade-name, as provided in the Trade-Mark Law. In all cases where opposition has been filed the Director of the Bureau of Commerce and Industry shall notify the applicant thereof.

SEC. 4. The Director of the Bureau of Commerce and Industry, shall decide all cases of opposition to the registration of a trade-mark or trade-name made, and shall deny the application or order the registration requested. Any party disagreeing with his decision may submit the matter to the courts of justice within thirty days after notification of such decision, otherwise the decision shall be final and unappealable. The decision of the Director of the Bureau of Commerce and Industry shall remain in effect until revoked by the court.

SEC. 5. Any cigar and cigarette manufacturers having unregistered trade-marks or trade-names on the date of the approval of this Act are hereby required to apply for the registration of such trade-marks or trade-names so long as the registration thereof has not been denied by the Director of the Bureau of Commerce and Industry: *Provided*, That applicants the registration of whose trade-marks is denied shall be entitled to sixty days' time after such denial during which to dispose of the products bearing the trade-mark denied.

SEC. 6. The Director of the Bureau of Commerce and Industry shall be empowered to promulgate, with the approval of the Secretary of Commerce and Communications, such rules and regulations as he may deem necessary to carry out the purposes of this Act.

SEC. 7. Any person, firm or corporation using a trade-mark or trade-name for cigars or cigarettes without first having the same registered in the Bureau of Commerce and Industry as provided in this Act shall be punished by a fine of not less than two hundred pesos nor more than one thousand pesos, or by imprisonment for not less than ninety days nor more than one year, or both, in the discretion of the court.

SEC. 8. All acts or parts of acts inconsistent with the provisions of this Act are hereby repealed.

SEC. 9. This Act shall take effect on its approval.

Approved, December 3, 1934.

EXCERPTS FROM TITLE VII OF THE REVENUE ACT OF 1921 OF THE UNITED STATES (TAX ON CIGARS, TOBACCO, AND MANUFACTURES THEREOF)

SEC. 700. (*a*) That upon cigars and cigarettes manufactured in or imported into the United States, and hereafter sold by the manufacturer or importer, or removed for consumption or sale, there shall be levied, collected, and paid under the provision of existing law, in lieu of the internal-revenue taxes now imposed thereon by section seven hundred of the Revenue Act of nineteen hundred and eighteen, the following taxes, to be paid by the manufacturer or importer thereof:

> On cigars of all description made of tobacco, or any substitute therefor, and weighing not more than three pounds per thousand, one dollar and fifty cents per thousand;

On cigars made of tobacco, or any substitute therefor, and weighing more than three pounds per thousand, if manufactured or imported to retail at not more than five cents each, four dollars per thousand;

If manufactured or imported to retail at more than five cents each and not more than eight cents each, 6 dollars per thousand;

If manufactured or imported to retail at more than eight cents each and not more than fifteen cents each, 9 dollars per thousand;

If manufactured or imported to retail at more than fifteen cents each and not more than twenty cents each, twelve dollars per thousand;

If manufactured or imported to retail at more than twenty cents each, fifteen dollars per thousand;

On cigarettes made of tobacco, or any substitute therefor, and weighing not more than three pounds per thousand, 3 dollars per thousand;

Weighing more than three pounds per thousand, 7 dollars and twenty cents per thousand.

(*b*) Whenever in this section reference is made to cigars manufactured or imported to retail at not over a certain price each, then in determining the tax to be paid regard shall be had to the ordinary retail price of a single cigar.

(*c*) The Commissioner may, by regulation, require the manufacturer or importer to affix to each box, package, or container a conspicuous label indicating the clause of this section under which the cigars therein contained have been taxpaid, which must correspond with the tax-paid stamp on such box or container.

(*d*) Every manufacturer of cigarettes (including small cigars weighing not more than three pounds per thousand) shall put up all the cigarettes and such small cigars that he manufactures or has manufactured for him, and sells or removes for consumption or sale, in packages or parcels containing five, eight, ten, twelve, fifteen, sixteen, twenty-four, forty, fifty, eighty, or one hundred cigarettes each, and shall securely affix to each of such packages or parcels a suitable stamp denoting the tax thereon and shall properly cancel the same prior to such sale or removal for consumption or sale under such regulations as the Commissioner, with the approval of the Secretary, shall prescribe; and all cigarettes imported from a foreign country shall be packed, stamped, and the stamps cancelled in a like manner, in addition to the import stamp indicating inspection of the customshouse before they are withdrawn therefrom.

SEC. 701. (*a*) That upon all tobacco and snuff manufactured in or imported into the United States, and hereafter sold by the manufacturer or importer, or removed for consumption or sale, there shall be levied, collected, and paid, in lieu of the internal-revenue taxes now imposed thereon by section seven hundred and one of the Revenue Act of nineteen hundred and eighteen, a tax of eighteen cents per pound, to be paid by the manufacturer or importer thereof.

(*b*) Section three thousand three hundred and sixty-two of the Revised Statutes, as amended by section seven hundred and one of the Revenue

Act of nineteen hundred and eighteen, is re-enacted without change as follows:

SEC. 8362. All manufactured tobacco shall be put up and prepared by the manufacturer for sale, or removal for sale or consumption, in packages of the following description and in no other manner.

All smoking tobacco, snuff, fine-cut chewing tobacco, all cut, or all granulated tobacco, all shorts, the refuse of fine-cut chewing, which has passed through a riddle of thirty-six meshes to the square inch and all refuse scraps, clippings, cuttings, and sweepings of tobacco, and all other kinds of tobacco not otherwise provided for, in packages containing one-eighth of an ounce, three-eighths of an ounce, and further packages with a difference between each package and the one next smaller of one-eighth of an ounce up to and including each package and the one next smaller of one-fourth of an ounce up to and including four ounces, and packages of five ounces, six ounces, seven ounces, eight ounces, ten ounces, twelve ounces, fourteen ounces, and sixteen ounces; *Provided,* That snuff may at the option of the manufacturer be put up in bladders and in jars containing not exceeding twenty pounds.

All cavendish, plug, and twist tobacco, in wooden packages containing thereon the manufacturer's name and place of manufacture, the registered number of the manufactory, and the gross weight, the tare and the net weight of the tobaccos in each package: *Provided,* That these limitations and descriptions of packages shall not apply to tobacco and snuff transported in bond for exportation and actually exported; *And provided, further,* That perique tobacco, snuff flour, fine-cut shorts, the refuse of fine-cut chewing tobacco, refuse scraps, clippings, cuttings and sweepings of tobacco, may be sold in bulk as material and without the payment of tax by one manufacturer directly to another manufacturer, or for export, under such restrictions, rules and regulations as the Commissioner of Internal Revenue may prescribe; *And provided, further,* That wood, metal, paper or other materials may be used separately or in combination for packing tobacco, snuff, and cigars, under such regulations as the Commissioner of Internal Revenue may establish.

In addition to the above, Philippine tobacco manufacturers should consult Regulations No. 47, Revised Regulations for Inspection of Leaf Tobacco and Manufactures Thereof Under the Provisions of Act No. 2613 of the Department of Finance (Promulgated May 12, 1925, XXIII Official Gazette, 57, page 955) and Regulations No. 27, as amended by Regulations no. 43, Regulations and Instructions Governing the Business of Manufacturers of Cigars and Cigarettes and Chewing and Smoking Tobacco (Promulgated March 1, 1923, XXI Official Gazette) of the Department of Finance also.

REGULATION NO. 47

SUBJECT: *Revised Regulations for Inspection of Leaf Tobacco and Manufactures Thereof under the Provisions of Act No. 2613.*

To All Internal-Revenue Officers and Others Concerned:

SECTION 1. In accordance with the provisions of section 79 (*b*) of the Administrative Code, as amended by Act No. 2803, in connection with section 6 of Act No. 2613, these regulations are promulgated to supersede

Administrative Orders Nos. 35 and 54 of the Bureau of Internal Revenue and Regulations No. 30 of the Department of Finance.

PART I.—LEAF TOBACCO

SEC. 2. *Drying and curing of tobacco.*—Section 2 of Act No. 2613, as amended, makes it unlawful to cure, dry or ferment leaf tobacco otherwise than in a building or curing shed constructed in accordance with the specifications of the Bureau of Agriculture. The specifications of said Bureau are appended hereto.

SEC. 3. *Sanitary rules respecting classification and packing of tobacco.*—(*a*) All operations connected with the classification and packing of leaf tobacco shall be performed either in a drying shed or curing house constructed in accordance with the specifications of the Bureau of Agriculture, or in the warehouse or workrooms of a registered wholesale tobacco dealer or manufacturer of tobacco products. Under no circumstances shall any dwelling house or living quarters be used for the purpose.

The operation must be carried on in factories in the manner prescribed in the regulations governing tobacco factories. In other places all manual operation pertaining to the classification or packing of leaves shall be carried on in a sanitary manner upon dry clean table, or upon dry clean mats spread upon floors or tables in such a way that neither the surface upon which the tobacco is handled nor the tobacco itself will be stepped upon by human beings or animals.

(*b*) *Insanitary acts.*—No person engaged in the classification or packing of leaf tobacco shall perform, cause, permit, or suffer to be permitted any insanitary act during such employment, nor shall any such person during such employment touch or contaminate any tobacco with his feet or with filthy hands, or use impure water or other unwholesome substance as a moistening agent, or trample, walk, or stand upon any tobacco or permit or suffer the same to be done; nor shall any person suffering from a dangerous communicable disease handle, touch, or manipulate leaf tobacco intended for consumption.

SEC. 4. *Classification of leaf tobacco.*—Leaf tobacco shall be classified as follows:

(*a*) *As to origin.*—The term "Isabela" will apply to tobacco grown in the province of Isabela; "Cagayan," to tobacco grown in the Province of Cagayan; and in the same way tobacco grown in other provinces will be designated by the name of the province of its origin.

(*b*) *As to length of leaf.*—Within each group there shall be six classes of leaf tobacco, viz., first, second, third, fourth, fifth, and sixth classes. The class of the tobacco, except the sixth class, is determined primarily by the length of the leaf and secondarily by the soundness of and the use for the leaf.

First-class tobacco leaf must have a length not less than 42 centimeters; second class, not less than 33 centimeters; third class, not less than 23 centimeters; and fourth class, not less than 16 centimeters. Tobacco leaf less than 16 centimeters will be classed as fifth or sixth class tobacco. A tolerance of 1 centimeter will be allowed in the lengths of each class, provided that the difference in each hand or pinongo is as often above as below the minimum herein fixed.

(*c*) *As to soundness.*—After determining the class of the tobacco in reference to its origin and length, its soundness and use will be judged. First class leaf tobacco must not be more than 5 per cent broken or worm-eaten; second class, not more than 8 per cent; and third class, not more than 10 per cent. Fourth class, if it have the length of first or second class leaf and be not more than 50 per cent broken or worm-eaten, may be qualified by the word "superior," but if its length is that of third or fourth and be not more than 25 per cent broken or worm-eaten, may be referred to as "current." Fifth class must be at least 90 per cent sound of any size. Sixth class comprises all tobacco not falling under any higher grade, and in this class shall be included all leaf which has not the requisite length or soundness for inclusion in a higher grade class, all leaf which lacks aroma, burning qualities, or elasticity, and all leaf which is dirty, musty, moldy, rotted, dried out, sapless, or otherwise spoiled, which has been handled under insanitary conditions, or which has not been dried and cured in a curing shed constructed in accordance with the specifications of the Bureau of Agriculture.

(*d*) *As to use.*—First, second, third, and fourth-class "superior" shall be further classified under the terms "fine" and "coarser." If the owner so desires, he may further qualify the term "fine" by the terms "claro," "colorado," or "maduro" to indicate the colors of the tobacco, provided these words are truthfully applied.

The term "fine," as herein used, shall be applied to leaf tobacco suitable for use as wrapper, taking into account its color, texture, and elasticity.

The term "coarse" shall be applied to leaf tobacco suitable for use as binder or filler and for the manufacture of cigarettes.

Furthermore for purposes of determining the classification of leaf tobacco as to its use, the aroma and burning qualities thereof shall likewise be considered.

(*e*) *Standard for export.*—First, second, third, and fourth class "superior" tobacco are considered as standard for export to the United States.

(*f*) *Abbreviations.*—The use of the following abbreviations is authorized in referring to the classification of leaf tobacco:

Fine	F	First	1st or 1.[a]
Coarser	C. or G.	Second	2nd or 2.[a]
Claro	Cl.	Third	3rd or 3.[a]
Colorado	Col.	Fourth	4th or 4.[a]
Maduro	Mad.	Fifth	5th or 5.[a]
		Sixth	6th or 6.[a]

SAMPLES OF MARKING

1919—Ilagan, Isabela	F—2nd
1920—Echague, Isabela	F—Cl–2d
1919—Solana, Cagayan	C—4.[a]–Superior
1921—Tuao, Cagayan	5.[a]
1919—Bauang, La Union	4.[a]–Superior
1920—Aringay, La Union	4.[a]–Current
1919—Rosales, Pangasinan	C—1.[a]
1919—Barili, Cebu	6.[a]

(*g*) *Classification before removal.*—Leaf tobacco before being removed from the province of origin must first be classified in accordance with

these regulations: *Provided, however,* That for the purpose of these Regulations the Provinces of Cagayan and Isabela shall be considered as one province: *and provided further,* That the classification herein required to be made shall not be understood as prohibiting the grower to sell leaf tobacco in palillos by the lot once such tobacco has been duly classified.

SEC. 5. *Packing of leaf tobacco.*—(*a*) *In bales, casks, or cases.*—Leaf tobacco before being sold in the Philippine Islands, and before leaving the province in which produced shall be packed in bales, casks, or cases, of standard weights as provided in section 5 (*a*) of Regulations No. 17. When packed for export by the actual exporter, other than standard weights may be used.

The provision relative to packing in accordance with Regulations No. 17 shall not apply to planters delivering tobacco of their own production to registered wholesale leaf tobacco dealers within the municipality in which the tobacco was produced.

When tobacco is packed in bales, the wrapping must be of burlap or matting (petate) made from buri, or other equally suitable material, so woven as to afford a surface sufficiently smooth to be marked permanently and legibly; the wrapping completely to cover the bale, which shall be securely bound with wire, *bejuco*, or a substitute equally suitable as a binder. Bales exported to the United States shall be wrapped in *saguran*, or equally suitable wrapping.

(*b*) *Preparation of the hand and bunch.*—Whether tobacco be packed in bales, casks, or cases, it must first have been arranged into bunches (pinongos) or hands (manos) as prescribed below:

(1) *Pinongo.*—The leaves are taken from the pole on which strung for drying, and classified in uniform size, soundness, color, and texture, and gathered into bunches (pinongos) of twenty leaves to the bunch and tied together with twine or fiber at the stems. If the packer so desires, he may, before baling, further gather five pinongos together and tie them at the stems, in the middle, and at the tips, forming what is known as a "carrot."

(2) *Old-style hand.*—The leaves are taken from the pole on which strung for drying and classified in uniform size, soundness, color, and texture.

The leaves are then folded along the midrib so that the under side (dorsal aspect) of the leaves faces out, and ten leaves of the same classification gathered into small bunches (manojitos) and ten of these bunches tied together into a hand in such a manner that the midribs are exposed. Each hand is tied at each end and in the middle with twine or fiber.

SEC. 6. *Marking of bales, casks, and cases.*—Each bale, cask, or case of leaf tobacco shall have permanently marked thereon the name of the province and municipality in which the tobacco was grown; the year in which harvested; the classification of the tobacco; and, in case it is subject to inspection, its net weight at the time when presented for inspection. No objection will be raised if additional private marks are shown, provided same are not false or misleading.

SEC. 7. *Inspection of leaf tobacco.*—Pursuant to the provisions of section 6 (c) of Act No. 2613, all leaf tobacco removed from the province of its origin shall be inspected, and inspection labels be affixed thereto in the manner hereinafter prescribed.

(*a*) *Inspection prior to shipment.*—The inspection shall be made at the point of shipment by the duly appointed tobacco inspectors of the Bureau of Internal Revenue. In places where there are no such inspectors the inspection shall be made by provincial treasurer or a deputy selected by him on account of his knowledge of leaf tobacco, unless the Collector of Internal Revenue shall have designated some other person to perform such inspection.

(*b*) *Shipment without prior inspection.*—Notwithstanding the foregoing provisions hereof, any person consigning tobacco to the City of Manila may secure from the provincial treasurer a permit, under Schedule L, paragraph 9, for the inspection of the tobacco at the point instead of at the point of embarkation, upon making an application on B. I. R. Form No. 3159 (old No. 525) provided for that purpose, in which it is agreed that the consignor, in consideration of this exemption, will submit the tobacco for inspection immediately upon its arrival at destination, will pay the proper inspection fees, and when so required by the Collector of Internal Revenue, recondition and repack the leaf tobacco to conform to the provisions of these regulations, should the tobacco be rejected upon inspection. Any provincial or deputy provincial treasurer or internal revenue agent may, upon presentation of the L–9 permit by the consignor, and a duly accomplished application for inspection, B. I. R. Form No. 31.61 (old No. 526), authorize the shipment without prior inspection, by signing a notation in the following form upon the L–3 guia of the shipper and in his official register book:

Shipment without prior inspection authorized this.. day of ...., 19..........., under permit L–9 .... for the year 19.............

....
(Signature)

....
(Title)

The shipping L–3 dealer will make the following notation on the advice slip corresponding to the shipment:

Shipped without prior inspection under permit L–9 No. .... for the year 19............

....
(Signature L–3———)

The application for inspection shall be attached by the consignor to the official guia corresponding to the shipment.

Any consignor who fails to submit the tobacco so shipped without prior inspection within five days after its arrival at point of destination after having agreed to do so shall have his L–9 permit revoked and shall thereafter be debarred from the privilege, and shall be proceeded against under the penal provisions of Act No. 2613. Persons shipping tobacco from the Province of Isabela to the City of Manila via Aparri, Cagayan, may by means of a similar agreement secure its inspection at the post of departure in Cagayan Province.

All leaf tobacco ultimately arriving in the City of Manila shall fall within the requirements of this section, even though same may pass through, or be detained for a time in, some other province. Leaf tobacco

for shipment to the United States shall be subject to the inspection provided for in this section.

(*c*) *Inspection fees for leaf tobacco.*—Section 8 of Act No. 2613 provides that for inspections made in accordance with this Act there shall be collected a fee of 25 centavos for each 100 kilograms of leaf tobacco or fraction thereof in the lot offered for inspection. Leaf tobacco which has undergone any process of manufacture, other than curing and fermenting, is subject to inspection and to the payment of the inspection fees as hereinafter provided for manufactured tobacco. (See section 14 of these Regulations.)

(*d*) *Application for inspections.*—The inspection of leaf tobacco shall be made upon application in the form of a declaration under oath by the person shipping the tobacco, on B. I. R. Form No. 31.61 (old No. 526.) Said application, while addressed to the Collector of Internal Revenue, shall be submitted to the inspector in charge at the point of inspection, and, to insure inspection, it should be in his hands at least one week before the scheduled date of shipment. A separate application must be made for leaf tobacco of each province offered for inspection. In case of shipment without prior inspection under an L–9 permit, the application shall be accomplished by the consignor, attached to the official guia, and presented by the consignee. All application for inspection shall be forwarded to the Collector of Internal Revenue at the end of each month by the inspector receiving them.

(*e*) *Making of inspections.*—Only tobacco packed in accordance with these Regulations shall be inspected. The inspector shall open up a sufficient number of bales selected at random (4 out of every 100 bales will ordinarilly suffice, but if the number of bales in the lot is less than 100, a greater percentage will be inspected), to determine whether the tobacco conforms with the classification and net weight stated in the application and marked on the bales. In case the classification of any of the tobacco is found to be different from that stated in the application, or the tobacco fails to comply with the requirements hereof as to packing and marking of the bales, the entire lot of tobacco shown in the application shall be rejected until brought within said requirements and submitted for reinspection. If the tobacco is of a lower class than that stated in the declaration, it will be considered as having been brought within the requirements of these regulations upon submission of a correct declaration and marking the bales with the true class; but this shall not be construed as permitting the mixing of tobacco of several classes. Inspection fees shall be collected on each inspection or reinspection. The tobacco offered for inspection must be stored in an accessible place and the person presenting the tobacco for inspection shall supply the labor required in moving the bales.

(*f*) *Issuance of inspection certificates and collection of fees.*—Upon completing the inspection, the inspector shall issue an inspection certificate on B. I. R. Form No 31.62 (old No. 506) issued in triplicate. The original certificate shall be delivered to the person presenting the tobacco; one copy shall be forwarded through the deputy provincial treasurer to the Collector of Internal Revenue, and one copy shall be retained by the inspector. Not later than five days after the date of inspection, the person offering the tobacco for inspection shall present the inspection certificate to the deputy provincial treasurer, in Manila, to the city treasurer, and pay the

amount of the inspection fees indicated thereon. It shall be the duty of the collecting officer to see that the fees are so paid and in case of default to demand payment thereof together with a compromise amount of at least ₱5. In the event of failure of settlement the matter should be reported to the Collector of Internal Revenue. But inspection fees may be allowed to accumulate from day to day not exceeding one month by the filling of a bond in an amount not less than ₱200 guaranteeing the payment of all such fees within the first five days of the month following that in which they have accrued.

The collecting officer shall note on the inspection certificate the number of the general receipt and the date of which collection of the amount due was made. At the end of each month and not later than the tenth day of the month following he shall submit to the Collector of Internal Revenue an abstract showing the numbers of certificates, the amounts of fees paid, the amounts of compromises accepted, and the numbers and dates of the corresponding general receipts.

(*g*) *Affixture of inspection labels.*—After the inspection certificate has been issued, the inspector shall supply the person presenting the tobacco for inspection with a sufficient number of inspection labels for affixture to the lot accepted, personally witnessing their affixture. The labels shall be attached by means of leaden seals and suitable wire. The wire shall be inserted through at least four pieces of the *bejuco* binder in such a manner as to make impossible the reuse of the seal if the packages are opened and repacked. Before shipping leaf tobacco which has been inspected, the inspector shall stamp the L–3 invoice and invoice stub with the words "Inspected, Certificate No. ....," which he shall fill in with the number of the inspection certificate. When tobacco which has been inspected prior to first shipment is reshipped in the original bales to another province, the inspector will, in case inspection is prerequisite to reshipment to the other province, note on the L–3 invoice and invoice stub "Inspected at .... prior to arrival in ....," (Inserting name of town in which inspected and province from which reshipment is to be made.)

PART II. MANUFACTURED PRODUCTS OF TOBACCO

SEC. 8. (*a*) *Cigars for export to the United States.*—For export to the United States, cigars must be manufactured under sanitary conditions from good, clean tobacco properly cured and seasoned, of a crop which has been harvested at least six months prior to the date of manufacture, exclusively the product of the Philippine Islands. However, imported wrappers may be used. The cigars must be well made, in the case of handmade cigars, with suitable spiral wrappers and with long filler from which must have been removed all stems, dust, scraps, or burnt tobacco: and in the case of machine-made cigars, from tobacco free from all stems, dust, and burnt tobacco. The manager or owner of the factory shall certify under oath that the cigars sought to be exported have been manufactured at least ten days before the date of shipment. No cigars for export to the United States shall be inspected without such certificate.

(*b*) *Packing.*—The cigars must be properly assorted and neatly and firmly packed in clean and thoroughly dried receptacles of wood not before

used, made from the native timber known as "calantas" or from imported cedar wood, or tin, unless permission is secured from the Collector of Internal Revenue to use other classes of wood or other suitable materials.

Containers must be marked to show the true shape or size, the make, whether handmade with long filler or machine-made with short filler, the date of packing and color of the cigars. By color is meant the color of the wrapper and not the filler. The word "claro" (light) shall apply to a very light wrapper, "colorado claro" (light red) to a light wrapper, "colorado" (red) to a medium wrapper, "colorado maduro" (red ripe) to a dark wrapper, and "maduro" (ripe) to a very dark wrapper. The marking with reference to the make as hereinbefore required shall consist of the affixture of a label on the front side of each cigar box and of another label on the inside of the cover showing whether the cigars therein contained are handmade with long filler or machine-made with short filler. These labels are manufacturer's labels and their cost will be defrayed by the manufacturers concerned. Containers in which the shapes, sizes, workmanship, and colors of the cigars packed are not uniform shall be rejected by the inspector.

(*c*) *Official inspection label.*—In addition to the labels referred to in the preceeding paragraph, there shall also be affixed to each cigar box an official inspection label. The inspection label shall contain information relative to the origin of the tobacco used in the manufacture of the cigars and their make, and to the supervision under which they were manufactured, graded, and packed. Consequently, it should be plainly shown whether the cigars are handmade with long filler from tobacco produced in the Cagayan Valley, or partly from tobacco grown in the valley and partly from tobacco of other regions, or entirely from tobacco grown outside of the Cagayan Valley, or are machine-made with short filler.

(*d*) *Things to be considered in determining quality.*—In passing on the quality of cigars, the article will be required to come up to a high standard as to workmanship, burn, aroma, and taste. The actual price at which the cigars are sold will also be given due weight, and when it is found that cigars are sold at such a low price that the cost of production with materials of the quality required in these regulations leaves no reasonable margin for profits, such fact may be considered as evidence in determining whether or not the cigars in question are fit for export to the United States.

SEC. 9. *Standard cigarettes defined, grades of cigarettes.*—There will be two grades of standard cigarettes, known, respectively, as "standard" and "selected" cigarettes. To be classed as standard, the cigarettes must be manufactured from good, clean tobacco, properly cured and seasoned. The cigarettes will be graded as selected if they conform to the foregoing specifications for standard cigarettes and the leaf used shall have been especially selected and stripped of the main stem, and the cigarettes have been made by and have been neatly and especially packed.

SEC. 10. *Standard smoking tobacco defined.*—To be classed as standard, smoking tobacco must be manufactured from good, clean leaf tobacco, properly cured and seasoned.

SEC. 11. *Standard defined as to other manufactured products of tobacco.*—Stemmed leaf, long filler, and short filler to be classed as standard for

export to the United States, must be manufactured from leaf tobacco of standard quality, and classified in accordance with the classification of the leaf used.

"Stemmed leaf" applies to clean, stemmed, unbroken leaf, free from mold or must.

"Long filler" applies to clean, long pieces of broken leaf, free from stems, waste, and cigar cuttings, suitable for use as filler without further preparation, and free from mold or must.

"Short filler" applies to clean, short pieces of broken leaf, free from stems, waste, and cigar cuttings, suitable for use as filler without further preparation, and free from mold or must. Only pieces of tobacco which will not pass through a screen of 2 centimeters mesh will be considered short filler.

"Cigar cuttings," applies to clean cuttings or clippings from cigars, unmixed with any other form of tobacco.

"Scrap tobacco" applies to all classes of partially manufactured tobacco not included in any of the above terms.

"Waste" applies to stems, powder, and denatured tobacco.

SEC. 12. *Declaration and application for inspection.*—In the case of shipment of tobacco products other than by mail, the manufacturer or exporter shall submit a sworn declaration in which he shall state that the tobacco products covered by the declaration are standard, within the definition of the terms contained in these regulations. This declaration shall constitute the manufacturer's or exporter's application for inspection, and must be in the hands of the Collector of Internal Revenue at least seventy-two hours prior to the advertised hour of shipment, except when, in the opinion of the Collector of Internal Revenue, sufficient reasons exist for accepting shorter notice of the intended shipment. No inspection will be made more than ten days in advance of the intended shipment, and in case an inspected shipment is for any reason held in Manila over ten days after inspection, the Collector of Internal Revenue will cause such reëxamination to be made as may be necessary to ascertain whether any deterioration has set in. In case of deterioration, the manufacturer must recondition the cigars and have a reinspection made.

SEC. 13. *Inspection and rejection apply to entire lot.*—Whenever a manufacturer offers a lot of tobacco products for inspection as above required which does not conform to the standard as provided in these regulations, all such tobacco products of the same kind and make in the lot offered for inspection shall be rejected until such time as they shall have been brought up to said standard, at which time they shall again be presented for inspection. The inspection fees are due for each inspection and reinspection made. The inspector shall inspect the contents of such number of packages as shall be deemed necessary to determine whether or not the lot offered for inspection conform to the establish standard.

SEC. 14. *Payment of inspection fees*—When a lot offered for shipment has been inspected, the inspector shall issue to the manufacturer an inspection certificate setting forth the quantity of tobacco products inspected, and whether accepted or rejected. The inspection fees are due on the entire lot inspected. The certificate shall be in triplicate. One copy shall be given the manufacturer, one copy shall be furnished the Collector of Internal Revenue, and the other copy shall be retained by the inspector.

The manufacturer shall present the certificate of inspection to the city treasurer, Manila, not later than five days after the close of the month in which inspection was made, and shall pay the inspection fees indicated thereon. The city treasurer shall take up the certificate, and issue in lieu thereof a general receipt, reading "For inspection fees, Act No. 2613. Certificate No. ...." He shall forward the certificate with his Statement of Collections to the Auditor General and send an abstract of such collections daily to the Collector of Internal Revenue, who shall check the same from time to time against such other data as may be available, to ascertain whether or not inspection fees were collected for the entire quantity of tobacco products exported to the United States.

If any person shall fail to pay in full all inspection fees due within five days after the end of the month during which inspection was made, as above required, he shall in the future, during such a period of time as the Collector of Internal Revenue may determine, be required to pay the inspection fees, together with all arrearages, before a certificate of origin will be issued to him.

SEC. 15. *Stamps and labels to be affixed by manufacturers and exporters.*—Manufacturers and exporters shall make a requisition upon the Collector of Internal Revenue for the official inspection labels needed by them, and shall keep a record of the number received and used. The stock on hand must at all times equal the difference between the number received and used. The internal-revenue stamps and other marks required by the United States Internal Revenue regulations shall be affixed to the packages prior to presentation for inspection, and the inspection labels shall be affixed after inspection.

SEC. 16. *Refund of value of stamps in cases of destruction and rejection.*—The face value of internal-revenue stamps destroyed by the inspector in opening packages for this purpose, and upon their destruction, stamps on cigars that are refused shipment to the United States will be refunded.

PART III.—GENERAL

SEC. 17. *Appeals.*—If any person feels aggrieved at the classification made, he may appeal to the officer immediately superior to the one making the inspection. To perfect an appeal the party aggrieved shall pay the inspection fees due on account of the inspection from which the appeal is made, and, in addition, to deposit with the deputy provincial treasurer, or in Manila, with the city treasurer, an amount equal to such inspection fees. He shall file with the inspector within five days from the date of inspection a written statement announcing his dissent from the inspector's decision and setting forth his grounds for disagreement. The inspector shall forthwith transmit the papers to his immediate superior with his comment, whereupon the latter shall proceed to reappraise the tobacco or tobacco products, giving the inspector and the appellant a hearing, if such action is deemed advisable by him. If the decision of the tobacco inspector is reversed by his immediate superior or if upon appeal the decision of the immediate superior is reversed by the Collector, the deposit shall be refunded. *Provided, however,* That the Collector of Internal Revenue may order another reinspection of any lot of tobacco if in his opinion such reinspection is warranted.

In case the appellant desires to forward his tobacco or tobacco products to Manila without awaiting the decision of the local officer appealed to, the appeal may be transferred to Manila.

SEC. 18. *Duties of carriers.*—No carrier by land or water shall transport leaf tobacco from any other province to another or to Manila, which does not bear the official inspection label of the Bureau of Internal Revenue and the invoice accompanying which does not bear a notation to the effect that the leaf tobacco contained in the consignment has been inspected. The same requirement shall be observed in the case of leaf tobacco to be transported to Manila unless the invoice accompanying the same bears the authority provided in section 7 (*b*) hereof.

SEC. 19. *Reconditioning in the United States.*—Section 10 of Act No. 2613 of the Philippine Legislature provides that:

Whenever cigars and cigarettes bearing the standard inspection label hereinbefore required shall arrive in the United States in a worm-eaten, musty, or moldy condition, or shall become worm-eaten within sixty days after arrival, the United States agent hereinbefore provided for, shall inspect same at the request of the importer or dealer and cause them to be reconditioned if practicable; if not, and the importer or dealer so desires, they shall be returned to the Philippine Islands. Expenses incurred in reconditioning such cigars in the United States or in transporting them back to the Philippine Islands from the place to which consigned when they left the Philippine Islands shall be borne by the Commonwealth Government.

(*a*) In order to secure the benefits of this section, the importer must report the alleged damaged condition to the Chief of the Bureau of Insular Affairs, War Department, Washington, D. C., or to one of the duly appointed Philippine tobacco agents in the United States within sixty days of their arrival at point of destination in the United States, in the case of musty, moldy, or worm-eaten cigars. In such report a request for inspection of the cigars must be made and the following data must be given:

(1) Shipping number found on cigar boxes.
(2) Ship on which goods were transported from Manila to the United States.
(3) Date of departure from Manila.
(4) Date of arrival in the United States.
(5) Port of entry in the United States.
(6) Name of exporter.
(7) Name of factory.
(8) Name and address of consignee.
(9) Date of receipt by consignee.
(10) Number or quantity of damaged goods.
(11) Quantity and kind of cigars received under each shipping number.
(12) Stamp classification.
(13) Name of manufacturer, exporter, importer, and owner of cigars who is entitled to or claims reimbursement.

(*b*) Upon receipt of the report stated in the preceding paragraph, a Philippine tobacco agent in the United States will inspect the cigars.

(1) In the case of worm-eaten, moldy, or musty cigars, where in the opinion of the Philippine Tobacco Agent inspecting the same, the damage is appreciable, such cigars and their containers may be destroyed in his presence. The Philippine Tobacco Agent will execute a certificate of destruction in quintuplicate (on B. I. R., Form No. 31.67 old No. 542), specifically describing the cigars and the United States internal-revenue stamps destroyed; one copy of which shall be furnished the owner of the cigars or his agent, two copies to the Chief of the Bureau of Insular Affairs, Washington, D. C., one copy to the Collector of Internal Revenue, Manila, and the remaining copy to be retained by him. Upon receipt of the certificate of destruction, and with the approval of the Chief of the Bureau of Insular Affairs, the Disbursing Agent, Philippine Revenues, Washington, D. C., will refund to the owner of the cigars or his agent the value of the United States internal-revenue stamps destroyed.

(2) In case the owner desires to return the worm-eaten, moldy, or musty cigars to the Philippine Islands, the Philippine Tobacco Agent will promptly report to the Chief of the Bureau of Insular Affairs, the weight, the measurement in cubic feet, and number of packages to be shipped, together with full information as to character of shipment, name of owner in the United States, and the name of the factory. Shipment of the damaged cigars to the Philippine Islands will then be arranged for by the Bureau of Insular Affairs from the place to which they were consigned when they left the Islands. Upon the arrival of the cigars in Manila the Collector of Internal Revenue will turn them over to the manufacturer for his disposition, and upon the destruction of the United States internal-revenue stamps make corresponding refund to him.

(3) In the case of moldy or worm-eaten cigars, the maximum allowance authorized for reconditioning will be fixed from time to time by the Collector of Internal Revenue; the allowance granted will be less than the maximum authorized when the mold or worm damage is slight. The reimbursement for reconditioning will be made by the Disbursing Agent of the Philippine Revenues upon certificate by the inspecting agent, approved by the Chief of the Bureau of Insular Affairs. The Commissioner of Internal Revenue, Washington, D. C., should be called upon to instruct the nearest collector of internal revenue in regard to emptying the cigars, destruction of the old stamps, repacking the cigars, under the supervision of a deputy, and the bale and affixture of new stamps; these stamps to be paid for by the Philippine tobacco agent out of funds advanced or reimbursed to him by the Disbursing Agent of the Philippine Revenues. When the stamps have been affixed, the deputy will file a certificate in duplicate, in such form as the Commissioner of Internal Revenue may prescribe, setting forth the fact that United States internal-revenue stamps in a certain amount were affixed to cigars imported from the Philippine Islands.

(4) In the case cigars are unsalable by reason of being worm-eaten, they may be reduced to scrap and reworked under the provisions of the United States internal-revenue regulations, provided the owner desires not to have them returned to the Philippine Islands. The value of the internal-revenue stamps on cigars so reduced to scrap, upon certificate of a United States internal-revenue officer or Philippine tobacco agent that said stamps had been destroyed, may be refunded.

(*c*) No allowance shall be made by the Government for expenses in connection with the reconditioning or returning to the Philippine Islands of damaged cigars, other than those set forth above. Losses due to reduced value of reconditioning cigars, the reimbursement or credit for cigars returned to the Philippine Islands, or destroyed in the United States, must be settled between the manufacturer and the purchaser. The Philippine Government will at all times, however, assist the parties in coming to an amicable agreement, and the Philippine tobacco agent will be available, should the parties so desire, to act as arbitrator. Importers and jobbers of Philippine cigars in the United States are cautioned to provide in their contract with the manufacturers what allowances they will receive beyond those granted by the government in accordance with these regulations.

SEC. 20 *Enforcement.*—Section 13 of Act No. 2613 specifies the Collector of Internal Revenue as the officer charged with the enforcement of the provisions of said Act and of the regulations issued in accordance therewith; but the Director of Agriculture is charged with the execution and the enforcement of the provisions of law referring to the cultivation of tobacco. Internal-revenue officers will bear in mind that the work pertaining to the securing of seeds, and demonstration work among tobacco planters as to proper cultivation methods pertains to the Director of Agriculture, and they shall take part in this work only when delegated so to do by the Director of Agriculture, with the approval of the Collector of Internal Revenue. Tobacco inspectors and internal-revenue officers generally enforce the provisions of law relating to tobacco *after it has been gathered.* They will accordingly see that the prohibitions against improper curing, fermenting, packing, and removal are enforced, and shall perform such other duties in connection with the tobacco after it is gathered as may be assigned to them in these regulations or by order from their superior officer.

SEC. 21. *Penalties.*—Any person who shall export or attempt to export from the Philippine Islands to the United States any tobacco that does not bear the inspection label hereinbefore required, and any person who shall knowingly violate any other provisions of Act No. 2613, or any of the rules herein promulgated, will be proceeded against under section 14 of Act No. 2613, which provides punishment by a fine not exceeding ₱500 or by imprisonment not exceeding six months, or by both penalties in the discretion of the court.

SEC. 22. *Effective date.*—These regulations shall take effect upon their promulgation in the Official Gazette but not before January 1, 1925.

PART VI. THE BUREAU OF PLANT INDUSTRY AND THE PROMOTION OF THE TOBACCO INDUSTRY

The various activities of the Bureau for the promotion of the tobacco industry are discharged through its Tobacco Research Section personnel which is composed of men with scientific training in agriculture. These men are specializing in tobacco work.

In accordance with the provisions of Plant Industry Administrative Order No. 1 dated August 19, 1933, the Tobacco Research Section "shall study all tobacco problems in the Philippines in all their phases—research, investigations and extension, including pest control,—for all of which it shall be given full coöperation by the other units of the Bureau. The work of this Section shall be carried out through funds made available by Act 2613 as amended, creating the Tobacco Board."

Following the provisions of the above administrative order, the work of the Tobacco Research Section resolves itself into two main categories, viz.: (a) Tobacco research and investigation, and (b) Tobacco extension.

TOBACCO RESEARCH AND INVESTIGATION

Research and investigation work are consistently undertaken at the Central Experiment Station, Manila; Ilagan Tobacco Station, Ilagan, Isabela; Maligaya Rice Station, Muñoz, Nueva Ecija; Los Baños Economic Garden, Los Baños, Laguna; Sta. Maria Plant Propagation Station, Sta. Maria, Ilocos Sur; Granja Sugar Cane Station, La Carlota, Occidental Negros; and at Davao Penal Colony, Davao. Coöperative experiments, trial plantings and investigations are also conducted in coöperation with tobacco growers in the principal tobacco regions.

Among the important researches and investigations of consequence that are being carried on are: (1) Tobacco breeding; (2) standardization of varieties; (3) introduction and acclimatization; (4) studies on the control of tobacco pests and diseases; (5) fertilizer requirements of tobacco; (6) tobacco chemistry; (7) tobacco physiology and morphology; (8) studies on the distances of planting; (9) regional and climatic adapta-

tion of the different types of tobacco; (10) utilization of sand leaves of filler tobacco for wrapper purposes; (11) determination of suitable materials for shading tobacco plantations and wrapping tobacco bales; (12) studies on burning quality; (13) studies on nicotine content; (14) studies on the costs of production; (15) studies on the utilization of Batek tobacco for the manufacture of chewing tobacco; (16) cultural requirements of the different types of tobacco; (17) curing and fermentation studies; (18) compilation of tobacco statistics.

Some of the tangible results of these researches and investigations are:

(1) The *Sumatra, Virginia* and *Turkish* types of tobacco which are now grown on a commercial scale were successfully introduced and acclimatized. Of the important successful introductions, the *Baker Sumatra, Florida Sumatra,* the *Adcock, North Carolina Bright Yellow, White Stem Orinoco, Conqueror, Warne, Gold Dollar* and the *Samsoun Bafra* stand out preeminently above the rest.

(2) New varieties were created like the *Ilagan Sumatra* while several promising hybrids, like the G_x, are now in the process of perfection. The utilization of F_1 generation hybrids for the commercial production of wrapper tobacco is now popularly practiced by wrapper growers.

(3) The undesirable mixed varieties are gradually being eliminated and substituted for by standard varieties. Our standard varieties *Vizcaya* and *Simmaba* are gradually crowding out other native varieties.

(4) A proper method of curing the Virginia tobacco has been devised through the adoption of flue-curing barns.

(5) Through experiments and trial plantings different types of tobacco have been found specially suited to specific regions of the country; on this basis all tobacco districts have been conveniently divided into zones according to type adaptability.

(6) By advising the farmers to resort to closer plantings and harvesting of sand leaves before they have attained full maturity, the same which were ordinarily discarded during cultivation are now being utilized in the production of wrapper tobacco.

(7) As a result of our findings showing calcium arsenate as a good and economical material in the control of the tobacco worms, its use among the farmers is now widespread resulting in considerable savings in labor.

(8) Abacá cloth was found very desirable material for shading seedbeds, tobacco plantations and for wrapping tobacco bales and as a result it is now commonly used by tobacco farmers and dealers.

(9) Growers are now safely initiated into the merits of perfected methods of curing, fermentation and classification of wrapper tobacco. As a result buyers have no more misgivings about the alleged haphazard preparation of the products for the market.

(10) A more effectual method of extracting nicotine from tobacco wastes was discovered, a fact which induced the resignation of one of our chemists to accept a better position in a private firm engaged in the manufacture of nicotine preparations.

(11) The results of our studies on the physiology and morphology of the tobacco plants opened for us new leads into an understanding of the intricate processes involved during curing and fermentation.

(12) The results obtained thus far from our fertilizer studies on the different types of tobacco ripped open the fundamental secret regarding tobacco nutrition and facilitated the giving of vital information to interested parties.

(13) The problem of control of the much dreaded green leaf spot disease of shade-grown wrapper tobacco has been fairly solved.

TOBACCO EXTENSION

The successful results of our researches and investigations are extended to the farmers by the Bureau through trial plantings; through actual field demonstrations and field drives; through farmers' meetings and conferences; through the issuance of tobacco circulars, bulletins and pamphlets; through participation in expositions, provincial and municipal fairs; and through replies to letters of inquiry. The work accomplished by the Bureau in the field of tobacco extension cannot be underestimated as may be gleaned from the following:

(1) *Wrapper leaf tobacco production.*—The intensive campaign waged for the production of wrapper tobacco from the sand leaves of filler tobacco in the Cagayan Valley; the establishment of the shade-grown tobacco industry in La Union, Ilocos Sur, and Batangas and the production of sun-grown Sumatra (open culture) in certain regions of Laguna and in the ha-

ciendas of the Tabacalera in Isabela are severally responsible for the gradual reduction of our wrapper importation from ₱2,000,000 in 1927 to only ₱600,000 in 1937.

(2) *Virginia tobacco production.*—Our drive towards the production of Virginia tobacco has not been as successful as that on wrapper tobacco due to weak market response. While the commercial possibilities of this type of tobacco have been conclusively proven, its development in the future is hinged on two difficulties; first, the construction of flue-curing barns which is a requirement that cannot easily be met by our small producers and second, the stiff competition offered by imported American cigarettes to the locally manufactured products, the local manufacturers not being in a position to guarantee the purchase of locally grown Virginia tobacco. Naturally, the demand being at low ebb, the farmers are not enthusiastic over growing Virgina tobacco for commercial purposes. However, there are several farmers in Central Luzon who are planting this type of tobacco more or less in abundance for their own consumption, as they have since found it highly suitable to their tastes.

(3) *Batek tobacco production.*—Where before only La Union and Pangasinan were the producers of Batek tobacco, now provinces like Nueva Ecija, Bulacan, Cagayan, and Isabela are producing this type of tobacco. This is another result of our tobacco extension activities.

(4) *Seed distribution.*—The distribution of seeds of standard varieties of tobacco to supplant the undesirable ones is another accomplishment credit for which goes to our extension work. In La Union and Pangasinan, the *Simmaba* is the dominant variety now grown by the farmers for the production of either batek, filler or wrapper tobacco, while the Sumatra varieties and hybrids are the ones planted by wrapper growers of Batangas. In the 1935–1936 season, the province of Cagayan desirous of improving her tobacco crop ordered over 100 kilos of seeds of *Vizcaya* and *Simmaba* tobacco for free distribution to the tobacco farmers. At 100 grams to the hectare, this amount should cover 1,000 hectares, representing a minimum cigar filler crop, valued at over ₱100,000.

(5) *Production of dual-or triple-crop from the same plantation.*—The simultaneous production of wrapper, batek, and filler tobacco from one and the same field originally designed for batek culture has been made possible as a result of our

educational campaign among the farmers. This is accomplished by harvesting the sand leaves before maturity and before the plants are topped and curing them summarily as wrapper tobacco. The plants are then topped to produce the batek crop. After harvesting the batek crop, the plants are allowed to develop suckers for the production of filler tobacco. This can also be done in the case of shaded plantations. Once the wrapper leaves are harvested and the shade removed, the plants are cut about a foot from the ground at the same time allowing suckers to grow for the production of filler tobacco. These methods of tobacco culture are innovations to increase the material income of the growers from the same plantation.

(6) *Classification, grading and sale of crops.*—While the classification, grading and selling of leaf tobacco do not properly belong to the functions of our Bureau, yet because the farmers and especially coöperators seek our aid regarding these matters, our tobacco men are obliged to render helpful aid to the producers from time to time. As soon as the crop is fermented, classification commences under the direction of our men. The crop is then baled for shipment to Manila. This is especially true with wrapper crops. The growers depend mostly upon our Bureau for the ultimate success of their enterprise—from the sowing of the seeds to the marketing of the crop. Buyers are contacted by our men and the growers come to Manila with their crop ready for immediate sale.

(7) *Forestry permits.*—Our tobacco men are also special forest officers authorized by the Bureau of Forestry to issue forestry permits to tobacco growers to cut timber in public forests free of charge for the construction of tobacco curing barns.

(8) *Tobacco publications.*—It is not amiss to mention in this connection that the Tobacco Research Section is one of the most steady contributors of articles for publication in our Journal of Agriculture and in the local press. (See Part VIII—Philippine Tobacco Bibliography.)

FUNDAMENTAL PROBLEMS OF THE TOBACCO INDUSTRY

(1) There are, as ever, three fundamental problems confronting the tobacco industry. First, is the low market bids for filler tobacco which is the dominant type of our production; the quotations being so low that producers cannot even recover their cost of production. The reasons for these unprecedented

low price levels are manifold. Faulty grading, classification and marketing system constitute one of the chief causes of low prices of leaf tobacco. The farmers are encouraged to sell their crop without benefit of classification. Then, too many middlemen who are employed by the buying firms share more of the price of the tobacco that should otherwise go to the producers. Another cause of low prices is the existence of a huge surplus over demand. Again, because the growers are invariably in a state of penury, they are forever indebted to representatives of buying firms and other buyers. It is a matter of common knowledge that many growers spend advance loans on their crops even before planting season. Naturally, if the crop to be produced is solely for the purpose of meeting a debt, the farmers do not usually pay particular attention to the quality of their production. This further contributes to the downward trend of prices.

What should be done to remedy these evils? The remedy for most of these problems belongs to other government entities. Suffice it to say that perhaps the enforcement of a more practical but rigid system of grading and classification of leaf tobacco, the elimination of the unnecessary middlemen by the organization of coöperative marketing associations among the producers, the construction of bonded tobacco warehouses, and the establishment of credit facilities for the growers may help maintain higher standards of market quotations for the product. If these remedies can be effected and with the Bureau doing its bit to improve the systems and methods of production, quality products will surely come as a consequence.

(2) The next or second difficulty which the tobacco industry faces today is the steady increase of importation of American cigarettes to the detriment of locally manufactured products. The annual importation of this commodity has steadily increased until its value now reaches the ₱6,000,000-mark, displacing a great portion of the local product. The solution of this problem is hitched on one particular. As already stated elsewhere in this paper the production of the raw materials locally for this kind of cigarette is practicable though not without difficulty. Local factories must strive to produce aromatic cigarettes similar to or the same in quality and price as the imported cigarettes if this item in our import is to be eliminated or minimized. After the factories have demonstrated their ability to do so as attested by public response, the supply of raw materials for the manufacture of this tobacco product will come in handy and in

sufficient quantity. It is contended that locally manufactured aromatic cigarettes are just as good as those imported, but because of certain Filipino idiosyncrasies as the preference for imported products, the advancement of this phase of the tobacco manufacturing industry is at a stalemate. However, if there is a market demand, the Bureau is always ready to stage a campaign for the big scale production of Virginia tobacco. Our production campaign for this type of tobacco is at present confined to producing it for the consumption of the producer himself so that instead of buying the imported cigarette from the sari-sari store he cuts and rolls his own or smokes it with his pipe. This is helping the country just the same.

(3) The third problem of the tobacco industry and perhaps the most potent of the three is an inactive market. The buyers are so limited in number that the absence of competition naturally reflects adversely upon the activity of the leaf tobacco market.

Incidentally, the function of our Bureau with regard to the promotion of the tobacco industry is confined to the cultural phase of the industry so that our activities have not been and are not so much disturbed or clogged by invisible pressures from any source. The evidence of our success can be envisaged from the list of activities and accomplishments as enumerated elsewhere in this paper.

Continuing our work based on the established policy laid down in administrative order No. 1 of our Bureau dated August 19, 1933, the following program of activities embodies the objectives of the Tobacco Research Section:

PROGRAM OF ACTIVITIES OF THE TOBACCO RESEARCH SECTION

As in the past the activities of the Section are divided into two groups, namely, (1) investigation and research, and (2) extension:

(1) INVESTIGATION AND RESEARCH

A. *Crop production.*—The production of the best quality and maximum yield possible of the different varieties under the different types of tobacco at the least expense through:

1. *Selection of the best variety and hybrid from the different strains and crosses already in existence.*

(*a*) Wrapper types .... Ip.[a]
5 varieties
6 strains
26 hybrids

[a] Pd. partly done; Ip. in progress; Pr. proposed.

(*b*) Cigar filler type .... Pd.
10 varieties
14 strains

(*c*) Aromatic cigarette type .... Pd.
18 varieties
18 strains
26 hybrids

(*d*) Miscellaneous types .... Ip.
(*e*) Domestication of wild species .... Ip.

2. *Study of cultural requirements of the different types of tobacco as regard—*

(*a*) Rate of seeding .... Pd.
(*b*) Proper distancing .... Pd.
(*c*) Season of planting .... Pd.
(*d*) Sources of seeds for planting.......... Pr.

(1) Effect of defoliation
(2) Effect of partial defoliation
(3) Effect of non-defoliation
(4) Effect of location of capsules on the inflorescence.

(*e*) Effect of soil types.......... Pr.
(*f*) pH value requirement.......... Pr.
(*g*) Soil moisture requirement .... Pd.
(*h*) Effect of depth of cultivation .... Pr.
(*i*) Relation of root and top development to depth of water table Pr.
(*j*) Effect of irrigation upon quality and yield of tobacco.......... Pr.
(*k*) Right age of leaf to harvest for the different types of tobacco Pr.
(*l*) Search for morphological correlation to right age of leaf to harvest .... Pr.
(*m*) The culture of Batek tobacco .... Pd.
(*n*) To determine the cause or causes of the production of batek spot .... Pr.

3. *Study of the climatic requirements of the different types of tobacco.*
(*a*) Regional adaptations .... Ip.
(*b*) Seasonal trial planting .... Pd.
(*c*) Recording of agricultural climatic data prevailing in tobacco regions .... Pd.

4. *Studies of the salt requirements of the different types of tobacco.*
(*a*) Fertilizer study with different types of tobacco.......... Ip.
(*b*) Study on the nutrition of tobacco with the object of correcting the proportion and components of different brands of fertilizers now available for sale.......... Ip.
(*c*) Effect of rare elements on yield and quality of leaf.......... Ip.
(*d*) Effect of color of soil upon growth and quality.......... Pr.

5. *Crop rotation experiments with tobacco.*
(*a*) Rice follows tobacco and vice versa.......... Ip.
(*b*) Legume follows tobacco and vice versa .... Pr.

(c) Onion follows tobacco and vice versa.. Pr.
(d) Corn follows tobacco and vice versa.. Pr.
(e) Sugar cane follows tobacco and vice versa.. Pr.

6. *Study of the curing requirements of different types of tobacco.*
(a) Effect of temperature.. Pr.
(b) Effect of humidity.. Pr.
(c) Effect of anaesthetics.. Pr.
(d) Effect of flavoring extracts.. Pr.

7. *Investigations on warehouse problems.*
(a) Studies on packing and baling in relation to mold control.... Pr.
(b) The search of suitable packing materials for leaf tobacco.... Pr.
(c) Baling studies on aromatic cigarette leaf tobacco.. Pr.
(d) Effect of varying temperature during aging upon the quality of cigarette and cigar filler tobacco.. Ip.

8. *Morphological and histological studies on tobacco.*
(a) Morphological characteristics of resistant varieties.. Pr.
(b) Anatomical study of the lamina of standard leaves of wrapper leaf tobacco in relation to texture and elasticity.. Pr.
(c) Morphological and anatomical properties of the different types and varieties of tobacco.. Ip.

9. *Introduction and acclimatization of promising foreign varieties.*
(a) Wrapper varieties
(b) Virginia varieties
(c) Turkish varieties
(d) Other varieties

B. *Investigations on tobacco diseases and pests.*—These consist of the search for varieties resistant to tobacco diseases and pests and the discovery of the most efficacious means of combating them.

1. Selection of resistant varieties.. Ip.
2. Hybridization of resistant varieties.. Pr.
3. Introduction of resistant varieties.. Pr.
4. Chemical control .... Pd.
5. Mechanical control .... Pd.
6. Natural-biological control .... Pr.

C. *Investigations on tobacco manufacture.*—These consist of a thorough understanding of the various processes involved in the manufacture and utilization of tobacco and tobacco products.

1. Studies on proper blending.. Pr.
2. Method of manufacture of chewing and cigarette tobacco.. Ip.
3. Control of molds on manufactured products.. Pr.
4. Study on flavoring extracts and wines.. Pr.
5. Effect of fertilizer upon quality of tobacco.. Pr.

(2) TOBACCO EXTENSION

1. *Wrapper leaf tobacco production through—*
   - (*a*) Utilization of sand leaves of filler and Batek tobacco............ Ip.
   - (*b*) Open culture in places with an even distribution of rainfall Ip.
   - (*c*) Shade culture.. Ip.
2. *Aromatic cigarette leaf tobacco production through—*
   - (*a*) Sun-curing Virginia for domestic supply of growers................ Ip.
   - (*b*) Flue-curing Virginia for commercial production for factories Ip.
3. *Improved Batek leaf tobacco production through—*
   - (*a*) Utilization of sand leaves for wrapper
   - (*b*) Standard leaves only for Batek proper
   - (*c*) Sucker leaves for cigar-filler
4. *Trial planting of the different types of tobacco in the different regions of the country.*
5. *Investigation of prospective tobacco lands as to climatic and soil suitability.*
6. *Control of tobacco pests and diseases.*
7. *Attending coöperators to properly cure, ferment, classify, bale and sell their crops.*
8. *Distribution of selected seeds of the different standard varieties of tobacco.*
9. *Studies on the cost of production in different regions.*
10. *Preparation of popular articles for press releases.*
11. *Compilation of tobacco statistics.*
12. *Extension to the growers of the successful results of our researches as they become ready for practical application.*
13. *Attendance and participation in farmers' conferences.*
14. *Preparation of reports.*

The technical personnel of the Tobacco Research Section are both research and extension workers discharging both phases of our activity simultaneously. This is not only practicable but also very desirable in view of their specialized training.

PROGRAM OF ACTIVITIES OF THE TOBACCO RESEARCH SECTION, BUREAU OF PLANT INDUSTRY

TOBACCO RESEARCH AND INVESTIGATION

1. *Selection and breeding work*
   - (*a*) Wrapper type
   - (*b*) Filler type
   - (*c*) Aromatic cigarette type
   - (*d*) Miscellaneous type
   - (*e*) Wild species

2. *Cultural requirements of the different types*
    (*a*) Rate of seeding
    (*b*) Proper distancing
    (*c*) Season of planting
    (*d*) Effect of shading
    (*e*) Maturity period
    (*f*) Age of leaf
3. *Climatic requirements of the different types*
    (*a*) Regional adaptation
    (*b*) Seasonal trial planting
    (*c*) Weather statistics
4. *Fertilizer requirements of the different types*
    (*a*) Fertilizer field experiments
    (*b*) Pot cultures
    (*c*) Effect of fertilizer on crop quality
5. *Crop rotation studies*
    (*a*) Rice follows tobacco
    (*b*) Legume follows tobacco
    (*c*) Corn follows tobacco
    (*d*) Sugar cane follows tobacco
    (*e*) Onion follows tobacco
6. *Curing requirements of the different types*
    (*a*) Effect of temperature
    (*b*) Effect of humidity
    (*c*) Effect of different poling systems employed
7. *Studies on warehouse problems*
    (*a*) Baling and packing
    (*b*) Suitable baling materials
    (*c*) Effect of temperature
    (*d*) Fermentation studies
    (*e*) Fumigation studies
8. *Morphological and histological studies*
    (*a*) Anatomical studies
    (*b*) Morphological studies
    (*c*) Comparative studies of structures of sun and open cultures
9. *Introduction and acclimatization work*
    (*a*) Wrapper varieties
    (*b*) Virginia varieties
    (*c*) Turkish varieties
    (*d*) Other varieties
10. *Investigations on pests and disease control*
    (*a*) Selection of resistant varieties
    (*b*) Hybridization of resistant varieties
    (*c*) Introduction of resistant varieties
    (*d*) Chemical control
    (*e*) Mechanical control
    (*f*) Natural-biological control

11. *Studies on tobacco manufactures and by-products*
    (*a*) Blending studies
    (*b*) Manufacture of chewing and smoking tobacco
    (*c*) Method of American cigarette manufacture
    (*d*) Mold control on manufactured products
    (*e*) Studies on flavoring extracts

TOBACCO EXTENSION WORK

1. *Wrapper tobacco production*
    (*a*) Sand leaves of filler and Batek plantation
    (*b*) Open culture by planting the Sumatras and hybrids
    (*c*) Shade culture
2. *Virginia tobacco production*
    (*a*) Sun-cured Virginia
    (*b*) Flue-cured Virginia
3. *Improved method of growing Batek*
    (*a*) Sand leaves for wrapper
    (*b*) Standards for Batek
    (*c*) Suckers for filler
4. Trial planting of the different types in different regions
5. Investigation of prospective tobacco land as to climatic and soil adaptability
6. Control of tobacco pests and diseases
7. Attending coöperators to properly cure, ferment and classify and bale their crop
8. Distribution of seeds of the standard varieties to growers
9. Gathering data on the cost of production in different places
10. Compilation of tobacco statistics
11. Preparation of popular tobacco articles for publication
12. Attending farmers' meetings and conferences and distribution of tobacco circulars and bulletins
13. Preparation of report

AGRICULTURAL ADJUSTMENT IN OUR TOBACCO GROWING INDUSTRY

Overproduction and the ultimate abolition of Philippine trade preferences in the American trade constitute the lurking dangers threatening our tobacco industry. Taken together, our average annual surplus and export to the continental United States in terms of leaf tobacco is around 180,000 quintals or practically one third of our total annual production. Overproduction has not only brought a huge surplus but at the same time has also reduced the price of tobacco leaf to the lowest level, thereby crippling the producers. On the other hand, the country is importing yearly ₱6,000,000 worth of American cigarettes

and ₱700,000 worth of wrapper and Virginia leaf which are used respectively for the wrapping of cigars for exports and for the blending of locally manufactured American-style cigarettes.

STATUS OF THE

PHILIPPINE TOBACCO INDUSTRY

BEFORE 1910

(Pre preferential trade era)

1. Total production	28,006,640 Kg.
2. Types raised	Cigar filler only
3. Exports (based on 1903 trade):	
Total value	₱3,894,000
4. Imports (based on 1903 trade):	
Total value	₱ 27,000
5. Crops rotated: Rice and corn.	

To remedy this deplorable situation and save the tobacco industry from its present impending danger, two things need be done without delay.

First, we must gradually eliminate the huge surplus of 100,000 quintals and the 80,000 quintals leaf tobacco equivalent of our United States exports in the form of cigars and stripped fillers if free trade terminates. Second, we must strive to produce the American and Sumatra types of tobacco which we are annually importing in such tremendous amounts. In other words, our 65,000 hectares planted to cigar filler tobacco every year must be reduced by about 18,000 hectares while at the same time we should put into cultivation around 6,000 to 8,000 hectares for the production of the aromatic cigarette type which we are importing in the form of American cigarettes. The reduction in areas will have to take place mostly in the Cagayan Valley and on the Ilocos Coast while the growing of the aromatic type or the Virginia tobacco should be encouraged in Central Luzon, Negros, Mindoro, Bohol, and Panay where the climate and soil conditions are favorable for the production of this type of American tobacco. Results of researches and investigations conducted for several years by the Bureau of Plant Industry conclusively show the practicability of producing this type of American tobacco economically. Hundreds of farmers in the above-mentioned provinces have already succeeded in growing this type of tobacco. Its production on a commercial scale is only a question of full coöperation and encouragement on the part of the local manufacturers.

PRESENT STATUS OF THE PHILIPPINE TOBACCO INDUSTRY
1910–1936

(American or preferential trade era)

1. Production (1936) .... 32,230,820 Kg.
2. Area planted .... 65,480 Ha.
3. Types raised:

Types	Area planted	Region
	Hectares	
Cigar-filler	63,700	Isabela, Cagayan, Pangasinan, La Union, Cebu, Occidental Negros, Iloilo, Ilocos Norte, Ilocos Sur, Leyte, Nueva Ecija and Surigao.
Cigarette-filler	Insignificant	Bulacan and Nueva Ecija.
Wrapper-leaf	150	La Union, Batangas, Laguna, Isabela and Cagayan.
Miscellaneous type	1,630	Ilocos provinces, Negros Island, Cebu and Batanes.

4. Exports (1927–1936 average basis):
   - Total value .... ₱13,904,000
     - Cigars 7,265,000
     - Leaf tobacco 5,840,000
     - Scraps, etc. 651,000
     - Cigarettes 137,000
     - Smoking tobacco 11,000
5. Imports (1927–1936 average basis):
   - Total value .... ₱5,965,000
     - Leaf tobacco 1,088,000
     - Cigarettes 4,062,000
     - Chewing tobacco 739,000
     - Smoking tobacco 75,000
     - Cigars 1,000
6. Crops rotated: Rice and corn.

WHAT TO DO WITH IDLE TOBACCO LAND

As a consequence of partial withdrawal of surplus tobacco areas from cultivation, the next problem to consider is to find suitable substitute crops. The Bureau of Plant Industry has long considered this eventuality and has gone ahead studying what should be grown in these areas. Right now the Bureau is in a position to tell what should be grown here and what should be grown there.

The Cagayan Valley is still deficient in her cereal food supply and must grow more rice and corn. The growing of corn in abundance in the Cagayan Valley is emphasized here because

the swine industry should be developed as a major industry in this region. The peanut, mungo, and the navy bean are now becoming important commercial crops of both Cagayan and Isabela. The area devoted to these crops should be greatly extended. Wheat, the products of which constitute a heavy import of the country, grows well in the Cagayan Valley, having been introduced there early during the Spanish regime. Indeed several farmers are still growing wheat on a small scale.

In the Ilocos region idle tobacco land should be devoted to the growing of rice, with mungo and cotton as secondary crops.

FUTURE STATUS OF THE PHILIPPINE TOBACCO INDUSTRY AFTER 1946

(Independence era)

1. Production .... 28,500,000 Kg.
2. Area planted .... 47,000 Ha.
3. Types raised:

Types	Area planted	Region
	Hectares	
Cigar-filler	42,300	Isabela, Cagayan, and Pangasinan.
Cigarette-filler	2,500	Central Plain of Luzon, Mindoro, Negros, Palawan, and the western and southern parts of Panay.
Wrapper-leaf	600	La Union, Batangas, Laguna, Ilocos Sur, and Southern Mindanao.
Miscellaneous type: Sulcok, Batek	1,600	Ilocos provinces, Negros, Cebu, and Mindoro.

4. Exports after 1946 (based on loss of American trade):

Total value	₱7,130,000
Leaf tobacco	5,800,000
Cigars	1,130,000
Cigarettes	122,000
Scraps, etc.	67,000
Smoking tobacco	11,000

5. Imports after 1946 (based on stopping of American trade):

Total value	₱221,000
Leaf tobacco	163,000
Cigarettes	29,000
Cigars	none
Chewing tobacco	none
Smoking tobacco	29,000

6. Crops rotated: Rice, corn, peanuts, beans, root crops, and vegetables.

GROWING THE AMERICAN CIGARETTE TOBACCO

A substantial portion of the sugar lands withdrawn from cultivation as a result of the fixed quota on sugar should be devoted to the growing of the aromatic cigarette type of tobacco. Central Luzon provinces and both Occidental and Oriental Negros which are greatly affected by the sugar limitation should take this opportunity. Because the sugar planters are well organized and because they constitute the moneyed class of our farming population, they can easily start this farming enterprise immediately on a big scale.

GROWING THE WRAPPER TYPE

Our importation of wrapper leaf tobacco from the United States and the Dutch East Indies amounts to around half a million pesos annually. This importation is, however, gradually being supplemented by local products grown in a special way in La Union, Batangas, and Laguna. The rapid development of southern Mindanao which is an ideal region for wrapper tobacco will not only accelerate the actual elimination of this imported commodity but may ultimately lead to the development of an export trade in competition with Java and Sumatra which are at present supplying the bulk of the world's demand for wrapper tobacco. The United States alone imports Sumatra wrapper leaf tobacco valued at around ₱20,000,000 annually. The soundness of our contention lies in the fact that the climatic and soil conditions of southern Mindanao are identical to those of Sumatra where the famous Sumatra wrapper is produced.

EXECUTION OF THE CROP ADJUSTMENT PROGRAM

To carry out effectively this agricultural adjustment in our tobacco region, it is necessary to reinforce the technical personnel of the Government in charge of the tobacco promotional work and to provide sufficient funds therefor.

Given adequate personnel and sufficient financial backing, it is believed feasible that within 6 to 8 years from now the tobacco growing industry may be so adjusted as to be insensible to the least trade jolt.

PART VII.—VITAL PHILIPPINE TOBACCO STATISTICS

TABLE 1.—*Area planted, production and value for the year ending June 30, 1935*

Province	Area planted	Production	Average yield per hectare	Average price per quintal	Total value
	Hectares	*Quintals*	*Quintals*		
Abra	430	3,120	7.25	₱4.10	₱12,520
Agusan	270	1,910	7.07	2.81	5,360
Albay	20	160	8.00	3.87	620
Antique	220	1,400	6.36	4.12	5,770
Bataan	-----	-----	-----	-----	-----
Batanes	30	160	5.33	4.37	700
Batangas	100	770	7.70	4.13	3,180
Bohol	180	1,550	8.61	3.95	6,120
Bukidnon	40	250	6.25	5.08	1,270
Bulacan	40	110	2.75	4.82	530
Cagayan	10,710	97,150	9.07	3.57	346,780
Camarines Norte	-----	-----	-----	-----	-----
Camarines Sur	20	90	4.50	5.33	480
Capiz	150	890	5.93	3.88	3,450
Cavite	80	500	6.26	7.26	3,630
Cebu	5,060	48,480	9.58	3.78	183,430
Cotabato	740	7,280	9.84	2.71	19,770
Davao	310	1,850	5.97	5.15	9,530
Ilocos Norte	2,390	17,370	7.27	3.00	52,090
Ilocos Sur	1,080	9,550	8.84	4.05	38,690
Iloilo	2,010	19,770	9.83	5.54	109,480
Isabela	12,560	183,330	14.60	3.58	655,740
Laguna	-----	-----	-----	-----	-----
Lanao	30	160	5.33	8.19	1,310
La Union	4,030	48,860	12.12	6.11	298,660
Leyte	1,970	15,970	8.11	6.21	99,170
Marinduque	80	440	5.50	4.00	1,760
Masbate	220	1,430	6.50	6.71	9,600
Mindoro	70	340	4.86	6.06	2,060
Mountain Province	320	2,260	7.06	5.57	12,600
Nueva Ecija	1,510	8,910	5.90	5.83	51,970
Nueva Vizcaya	330	2,920	8.85	5.57	16,280
Occidental Misamis	310	2,770	8.93	2.83	7,830
Oriental Misamis	190	1,620	8.53	8.51	13,780
Occidental Negros	1,900	16,030	8.44	3.74	60,040
Oriental Negros	2,270	21,680	9.55	2.81	60,880
Palawan	50	310	6.20	10.97	3,400
Pampanga	-----	-----	-----	-----	-----
Pangasinan	10,130	90,180	8.90	4.11	370,960
Rizal	40	360	9.00	4.08	1,470
Romblon	90	870	9.67	4.39	3,820
Samar	320	2,050	6.41	9.54	19,560
Sorsogon	-----	-----	-----	-----	-----
Sulu	190	1,380	7.26	4.54	6,260
Surigao	490	3,960	8.08	5.90	23,380
Tarlac	170	1,540	9.06	4.48	6,900
Tayabas	190	1,240	6.53	7.15	8,870
Zambales	40	230	5.75	5.78	1,330
Zamboanga	140	1,460	10.43	4.16	6,080
PHILIPPINES	61,520	622,660	10.12	4.09	2,547,110

TABLE 2.—*Government revenue from the tobacco industry*

Items	1930	1931	1932
Sales taxes	₱137,584.66	₱120,416.50	Not secured.
Specific taxes:			
(*a*) Domestic	6,325,272.72	5,650,288.82	5,157,157.34
(*b*) Imported	1,641,514.56	1,253,735.86	2,311,798.84
Privilege tax	535,925.12	1,283,741.18	427,985.84
U. S. specific taxes on tobacco collected in the Philippines and revertible to the Philippine Treasury	637,410.32	690,691.40	709,858.74
Tobacco inspection fees	143,830.84	161,416.42	160,081.86
Total	9,421,538.22	8,360,290.18	8,766,882.62

Items	1933	1934	1935
Sales taxes	₱66,057.28	₱121,157.04	₱126,532.68
Specific taxes:			
(*a*) Domestic	5,058,755.24	4,266,804.04	4,332,841.04
(*b*) Imported	1,444,773.06	2,377,673.86	2,740,068.08
Privilege tax	411,179.64	415,220.04	410,048.90
U. S. specific taxes on tobacco collected in the Philippines and revertible to the Philippine Treasury	755,644.34	852,773.64	838,523.36
Tobacco inspection fees	145,205.80	136,080.54	163,609.46
Total	7,881,635.36	8,169,709.56	8,611,623.52

TABLE 3.—*Summary of Philippine tobacco exports*

Articles		1936		1935	
Tobacco	Unit	Quantity	Value	Quantity	Value
Leaf	Kilos	14,442,474	₱4,532,606	22,412,659	₱4,614,920
Cigars	Number	178,334,078	5,492,655	223,117,286	6,798,760
Cigarettes	do	17,144,495	53,793	16,273,383	43,942
Smoking	Kilos	3,725	1,984	6,994	3,314
All other tobacco products	Kilos	1,136,340	408,530	1,542,518	542,722
Total tobacco products			10,489,566		12,003,658

TABLE 4.—*Leading importers of Philippine tobacco*

Tobacco products	1936		1935	
	Quantity	Value	Quantity	Value
Cigars:	*Number*	*Pesos*	*Number*	*Pesos*
United States	158,977,240	4,744,362	204,013,225	6,060,436
China	5,539,745	217,374	5,937,695	212,484
Hawaii	4,501,178	211,443	4,261,845	202,751
British East Indies	1,925,939	81,072	1,868,819	80,321
Hongkong	616,045	46,463	783,500	58,146
Great Britain	1,159,380	38,441	1,240,069	42,714
France	1,434,500	27,663	1,909,525	39,570
Spain	1,668,360	21,389	1,012,125	5,943
Japan	354,250	19,724	512,400	26,929
French East Indies	311,195	17,573	227,890	13,331
Switzerland	344,970	12,160	84,625	5,790
Netherlands	166,760	6,169	135,155	3,913
Japanese China	100,260	5,874	169,580	9,372
Egypt	247,700	5,868	136,925	3,918
British Africa	175,000	5,600	165,860	4,978
Siam	61,625	4,357	35,530	2,781
French Africa	112,000	3,788	42,000	1,430
Gibraltar	153,000	3,563	----------	----------
Australia	42,000	2,517	46,030	2,726
Dutch East Indies	75,425	2,408	64,005	3,008
New Zealand	36,000	2,077	9,035	552
Norway	31,271	1,893	28,915	2,049
Panama	40,000	1,600	40,300	1,615
Denmark	61,225	1,486	145,140	4,127
Portugal	25,000	1,400	----------	----------
Guam	40,810	1,189	31,825	1,427
Sweden	23,575	1,105	10,058	231
Germany	18,200	936	33,935	1,671
Belgium	30,000	729	62,025	1,625
Aden	15,425	576	25,400	944
Dutch West Indies	11,000	565	----------	----------
Portuguese East Indies	16,500	405	25,600	640
Korea	4,750	325	5,000	249
Argentina	2,250	158	----------	----------
Turkey in Asia	5,000	149	----------	----------
Italy	2,500	104	21,300	1,728
Portuguese Africa	2,000	74	3,800	271
Persia	2,000	74	4,000	180
Portuguese China	----------	----------	14,750	445
Palestine	----------	----------	6,400	324
Greece	----------	----------	3,000	141
Total	178,334,078	5,492,653	223,117,286	6,798,760
Leaf tobacco:	*Kilos*	*Pesos*	*Kilos*	*Pesos*
Spain	9,622,942	2,930,311	16,280,630	3,169,303
Italy	1,045,948	402,287	1,627	391
France	1,617,370	359,749	376,830	129,850
Korea	792,988	334,181	3,656,080	739,413
Japan	623,437	246,698	1,073,891	298,311
French Africa	210,552	79,916	234,018	71,740
China	187,867	53,469	254,512	70,414
Hongkong	172,575	46,583	141,200	31,813
Netherlands	82,205	38,391	70,088	20,356
Guam	24,740	12,402	12,652	7,280

TABLE 4.—*Leading importers of Philippine tobacco*—Continued

Tobacco products	1936		1935	
	Quantity	Value	Quantity	Value
Leaf Tobacco—Continued	*Number*	*Pesos*	*Number*	*Pesos*
Gibraltar	18,206	6,720	16,648	4,199
Australia	12,343	6,493	22,184	10,402
British East Indies	9,542	5,749	4,807	2,541
Japanese China	8,438	3,125		
Belgium	6,503	1,880	124,901	34,350
Great Britain	1,199	1,721	897	750
Dutch East Indies	2,790	1,142	3,165	1,105
Uruguay	2,478	1,313		
United States	201	107		
Hawaii	120	54	706	330
French East Indies	30	15	90	45
British Africa			136,114	21,066
New Zealand			1,520	1,216
Czechoslovakia			85	25
Siam			14	20
Total	14,442,472	4,532,606	22,412,659	4,614,920
Cigarettes:	*Number*	*Pesos*	*Number*	*Pesos*
Portugal	1,050,000	15,000	40,000	124
Japan	5,000,000	10,200	4,500,000	9,188
United States	737,950	6,342	1,387,980	12,687
Great Britain	1,131,950	4,120	449,148	1,430
Spain	1,534,979	3,490	1,258,000	1,063
Hongkong	2,278,500	3,797	1,862,250	3,380
Egypt	1,500,000	2,625		
China	1,218,420	2,192	1,695,300	3,638
Portuguese China	1,132,500	2,021	1,306,550	2,515
Hawaii	135,000	1,134	311,500	2,607
Norway	322,250	968		
British East Indies	480,000	712	637,350	1,445
Portuguese East Indies	201,750	310	183,000	256
French East Indies	48,300	209	119,900	364
Japanese China	155,000	205	121,600	157
Australia	104,112	180	89,510	183
Guam	67,284	165	34,295	79
Netherlands	18,000	60		
Dutch East Indies	21,000	38	18,000	38
Denmark	6,000	20	9,000	68
Germany	1,500	5		
France			1,000,000	2,713
Canary Islands			1,250,000	1,007
Total	17,144,495	53,793	16,273,383	43,942

TABLE 4.—*Leading importers of Philippine tobacco*—Continued

Tobacco products	1936		1935	
	Quantity	Value	Quantity	Value
	Kilcs	*Pesos*	*Kilos*	*Pescs*
Tobacco:				
Scraps, stripped filler, and cigar ends—				
United States	973,585	373,288	1,370,845	504,006
Netherlands	41,755	15,337	69,588	24,735
Belgium	12,635	4,877	7,206	2,104
French Africa	16,309	4,633		
Gibraltar	10,810	2,594	24,990	6,038
New Zealand	1,425	1,140		
Japan	4,500	1,000		
British East Indies	2,388	973	8,066	3,249
China	4,180	870	1,478	115
Dutch East Indies	707	93		
Total	1,068,294	404,805	1,482,173	540,247
Smoking or cut tobacco:				
Spain	2,300	899	2,500	1,141
China	1,036	648	874	529
British East Indies	338	372	1,450	427
Hongkong	50	64	50	64
French East Indies	1	1		
Canary Islands			2,320	1,153
Total	3,725	1,984	6,994	3,314
All other tobacco products:				
British East Indies	9,168	2,852	3,955	1,202
China	56,078	855	54,545	1,220
Hongkong	2,800	18	1,840	52
United States			5	1
Total	68,046	3,725	60,345	2,475

TABLE 5.—*Philippine tobacco imports*

Tobacco products	1936		1935	
	Number	Pesos	Number	Pesos
Cigarettes:				
United States	1,893,867,719	5,857,740	2,056,224,343	6,153,235
Hongkong	33,550	516	30,100	422
China	17,550	313	36,060	359
Austria	100	2		
Netherlands			1,500	20
Australia			1,060	16
Switzerland			1,000	12
Great Britain			250	10
Germany			1,000	8
Total	1,893,918,919	5,858,571	2,056,295,313	6,154,082
Leaf tobacco:	*Kilos*		*Kilos*	
United States	295,238	748,851	193,921	575,612
Dutch East Indies	7,727	88,314	7,508	92,128
Netherlands			155	1,010
Cuba			872	967
Total	302,965	837,165	202,456	669,928
Chewing tobacco:				
United States	166,303	377,764	272,844	577,928
Total	166,303	377,764	272,844	577,928
Smoking tobacco:				
United States	20,381	45,737	37,679	80,404
China	6,100	9,254	6,699	11,984
Hongkong	67	743	76	861
Great Britain	59	487	72	644
Netherlands	2	6		
Switzerland		1		
Japan	1	1	2	32
Cuba				
Total	26,610	56,229	44,229	93,932
Cigars:	*Number*		*Number*	
United States	276	40	105	8
Cuba	420	26	50	2
Dutch East Indies			50	4
Total	696	66	205	14
All other tobacco products:	*Kilos*		*Kilos*	
United States	310	1,065	5,774	4,986
Total		7,130,860		7,500,559

TABLE 6.—*Value of imports of leaf tobacco and tobacco products from the United States*

Year	Value	Per cent total tobacco importation
1926	₱3,935,337	91.62
1927	4,928,593	89.74
1928	6,010,912	96.91
1929	6,302,411	96.34
1930	5,607,794	95.24
1931	5,337,943	98.06
1932	5,253,936	97.55
1933	4,169,254	98.33
1934	5,714,657	97.62
1935	7,392,173	98.55
1936 (10 months)	6,324,323	----------

TABLE 7.—*Value of exports to the United States of tobacco and tobacco products*

Year	Value	Per cent of total exports of tobacco and tobacco products
1926	₱9,448,793	54.73
1927	8,058,060	45.23
1928	8,768,293	51.15
1929	6,849,684	38.96
1930	6,705,605	42.79
1931	6,813,908	45.91
1932	6,486,682	50.68
1933	5,951,968	57.48
1934	6,727,306	64.75
1935	6,577,130	54.79
1936 (10 months)	4,424,210	----------

TABLE 8.—*Cigarette importations from the United States compared with the total production of said article in the Philippines*

Year	Imports	Total cigarette production in the Philippines	Per cent of imports
1926	417,936,501	4,954,572,127	8.43
1927	542,053,520	4,995,022,912	10.85
1928	708,957,981	5,110,187,247	13.87
1929	1,019,805,620	4,974,599,866	20.50
1930	1,075,737,000	4,718,684,523	22.79
1931	1,131,929,900	4,236,038,893	26.72
1932	1,053,483.207	3,953,734,473	26.64
1933	762,168,761	3,554,651,125	21.44
1934	1,488.725,890	2,966,435,450	50.18
1935	2,056,224,343	2,986,494,142	68.85
1936 (10 months)	1,710,042,899	----------------	----------

TABLE 9.—*Yearly average of cigarettes withdrawn for local consumption during the 10-year period, 1926–1935*

	Number	Per cent
Philippine manufacture	4,176,396,820	79.93
Imported cigarettes	1,048,322,520	20.07
	5,224,719,340	100.00
Year 1926—		
Philippine manufacture	4,903,210,975	92.22
Imported cigarettes	413,748,233	7.78
	5,316,959,208	100.00
Year 1935—		
Philippine manufacture	2,969,962,760	59.93
Imported cigarettes	1,985,401,578	[a] 40.07
	4,955,364,338	100.00

TABLE 10.—*Imports and exports of leaf tobacco*

Year	Imports from U. S.		Exports to the U. S.	
	Quantity in kilos	Value	Quantity in kilos	Value
1926	332,562	₱1,210,001	4,250	₱7,639
1927	298,780	1,292,166	71,294	57,895
1928	259,074	1,707,249	56,526	31,792
1929	201,532	990,312	47,178	25,208
1930	166,835	608,454	191,656	97,391
1931	348,470	604,705	107,097	82,535
1932	836,562	704,812	193,663	83,723
1933	1,665,457	1,126,144	60,998	17,029
1934	566,729	896,218	20,120	7,318
1935	193,921	575,612	----------	------------
1936 (10 months)	242,255	627,346	200	106

[a] This percentage differs from the proportion mentioned in table 8. The figures quoted here refer to the exact number of cigarettes imported in 1935 as compared with the local production of the same period. December importations generally are not withdrawn for consumption until the next year.

TABLE 11.—*Philippine leaf tobacco transaction during the 10-year period, 1926–1935 (yearly averages)*

	Kilos	Percentage of production
Rawleaf export—		
To Spain	13,349,982	30.95
To other countries	6,240,390	14.45
Stripped tobacco, scraps, etc.—		
To United States	1,332,850	3.10
To other countries	308,102	0.70
Leaf used in local factories	10,020,093	23.20
Loss in manufacture [a] (stems, waste, etc.)	4,000,000	9.30
Growers' home consumption B–14, losses [b]	7,894,583	18.30
Estimated production according to Bureau of Plant Industry	43,146,000	100.00%

[a] Estimated. [b] Estimated to arrive at crop total.

"Not considering growers' home consumption, B–14, losses, the *legitimate industry and commerce* dealt with an average yearly volume of 34,251,417 *kilos* distributed as follows:

	Per cent
Rawleaf exported to Spain	37.90
Rawleaf exported to other countries	17.70
Stripped tobacco, etc., exported to United States	3.80
Stripped tobacco, etc., exported to other countries	0.80
Used in local factories, including loss through stemming, waste, etc.	39.80
	100.00

TABLE 12.—*Cigar exports to the United States*

Year	Quantity	Value
	Number	*Pesos*
1926	195,326,896	₱9,138,435
1927	167,300,765	7,537,831
1928	179,569,767	7,711,343
1929	150,945,425	6,026,710
1930	144,767,520	5,620,557
1931	158,520,284	5,770,731
1932	164,615,726	5,771,048
1933	180,714,153	5,646,233
1934	203,895,812	6,463,543
1935	204,013,225	6,060,436
1936 (10 months)	137,927,420	4,139,377

TABLE 13.—*Value of total tobacco importations from the United States during the last decade, including other commodities and merchandise used in the tobacco industry.*

Year	Value
1926	₱4,050,770
1927	5,014,559
1928	6,116,773
1929	6,359,773
1930	5,701,583
1931	5,533,195
1932	5,326,339
1933	4,558,186
1934	6,214,895
1935	7,651,418
1936 (10 months)	6,337,992

TABLE 14.—*Comparative value of total tobacco trade between the United States and the Philippines*

Year	Imports	Exports
1926	₱4,050,770	₱9,448,793
1927	5,014,559	8,058,060
1928	6,116,773	8,768,293
1929	6,359,773	6,849,684
1930	5,701,583	6,705,605
1931	5,533,195	6,813,908
1932	5,326,339	6,486,682
1933	4,558,186	5,951,968
1934	6,214,895	6,727,306
1935	7,651,418	6,577,130
1936 (10 months)	6,337,992	4,424,210

TABLE 15.—*Cigar exports by United States classification*

Year	A	B	C	D	E
	Number	*Number*	*Number*	*Number*	*Number*
1930	151,231,542	1,797,492	1,014,670	1,200	89,510
1931	164,547,258	1,211,982	426,025	800	7,100
1932	175,295,494	686,730	236,450	800	39,730
1933	184,733,304	166,990	152,955	800	2,200
1934	207,571,212	516,695	178,275	600	2,000
1935	208,181,968	299,965	160,170	32,830	1,250
Total	1,091,560,778	4,679,854	2,168,545	37,030	141,790

Tax per M., cost of production and market value

U. S. class	Tax	Cost of production	Market value
	Per M.	*Per M.*	*Per M.*
A	₱4.00	₱20 to ₱28	₱28.60
B	6.00	44 to 56	80.00
C	10.00	55 to 90	117.00
D	21.00		180.00
E	27.00		300.00

TABLE 16.—*Value of the tobacco trade between the United States and the Philippines for the years 1933, 1934, and 1935*

IN FAVOR OF THE UNITED STATES

Value of total tobacco imports	₱18,424,499
Freight on imports—ocean and railway	572,762
Freight on exports—ocean and railway	2,004,230
Insurance on imports and exports	330,747
Grand total	₱21,332,238

IN FAVOR OF THE PHILIPPINES

Value of total tobacco exports	₱19,256,404
Balance favorable to the United States	2,075,834
Rate of insurance on import products	3/4 of 1%
On exports	1%

The insurance estimated has been based on the total value of imports and exports.

TABLE 17.—*Value of total imports and exports*

Year	Imports	Exports
1909	₱98,098	[d] ₱1,484,054
1910 [a]	397,958	[d] 3,156,408
1911	283,996	[d] 1,841,352
1912 [b]	365,406	[d] 3,989,630
1913	530,948	3,317,517
1914	520,734	2,424,018
1915	711,916	2,339,799
1916	764,716	4,456,620
1917	1,106,790	10,544,945
1918	1,564,709	14,667,875
1919	2,056,043	14,021,093
1920	3,692,202	22,133,305
1921	5,354,766	4,076,800
1922	2,217,438	8,787,463
1923	2,284,987	10,726,800
1924	2,790,540	9,141,110
1925	3,579,796	10,432,704
1926	4,050,770	9,448,793
1927	5,014,559	8,058,060
1928	6,116,773	8,768,293
1929	6,359,773	6,849,684
1930	5,701,583	6,705,605
1931	5,533,195	6,813,908
1932	5,326,339	6,486,682
1933	4,558,186	5,951,968
1934	6,214,896	6,727,306
1935	7,651,418	6,577,130
1936 [c]	6,337,992	[c] 4,424,210
Total	91,186,616	204,353,125

[a] The figures for 1910 are for six months only, July to December.
[b] The figures for 1912 are for a whole fiscal year ending June 30, 1912.
[c] The figures for 1936 are for ten months only, January to October.
[d] The figures for 1909, 1910, 1911 and 1912 are for fiscal years ending June 30.

TABLE 18 (*a*).—*Exports to the United States of tobacco and tobacco products*

Year	Leaf tobacco		Cigars		Cigarettes	
	Quantity	Value	Quantity	Value	Quantity	Value
	Kilos	*Pesos*	*Number*	*Pesos*	*Number*	*Pesos*
1909 [a]	5,520	3,338	37,076,000	1,474,792	2,173,000	5,924
1910 [a]	3,372	3,014	61,526,000	3,121,598	8,823,000	31,796
1911 [a]	2,545	1,488	38,112,000	1,804,756	5,547,000	21,564
1912 [a]	40,205	25,034	90,000,000	3,916,642	10,968,000	47,928
1913 [b]	4,485	4,518	71,513,141	3,285,776	6,747,560	27,156
1914 [b]	23,650	10,302	56,205,050	2,400,252	3,054,807	10,202
1915 [b]	41,017	20,671	61,169,600	2,302,444	3,706,575	16,684
1916	466,419	237,306	111,478,216	4,066,242	2,993,600	11,622
1917	1,360,550	1,204,051	202,198,534	7,725,966	2,505,966	10,125
1918	606,006	584,030	248,747,584	11,365,675	6,405,000	15,715
1919	35,751	31,250	263,942,555	13,828,639	3,978,450	17,984
1920	386,562	592,403	316,862,859	21,092,607	2,144,900	15,300
1921	36,817	53,886	68,216,608	3,960,503	833,048	8,494
1922	9,864	12,304	173,317,045	8,519,576	823,060	5,990
1923	129,758	105,704	219,898,014	10,298,229	1,716,250	10,624
1924	30,105	19,143	175,761,928	8,839,563	435,800	3,659
1925	2,872	1,824	207,279,935	10,051,192	888,030	6,921
1926	4,250	7,639	195,326,896	9,138,435	1,743,070	13,771
1927	71,294	57,795	167,300,765	7,537,831	1,949,122	16,143
1928	56,526	31,792	179,569,767	7,711,343	1,857,340	15,313
1929	47,178	25,208	150,945,425	6,026,710	3,932,048	32,325
1930	191,656	97,391	144,767,520	5,620,557	2,995,950	21,115
1931	107,097	82,535	158,520,284	5,770,731	1,445,350	13,757
1932	193,663	83,723	164,615,726	5,771,048	1,012,100	9,548
1933	60,998	17,029	180,714,153	5,646,233	911,000	8,775
1934	20,120	7,318	203,895,812	6,463,543	1,374,700	11,698
1935	----------	----------	204,013,225	6,060,436	1,387,980	12,687
1936 [c]	200	106	137,927,420	4,139,377	593,950	5,087

[a] The figures for 1909, 1910, 1911 and 1912 are for fiscal years ending June 30.
[b] Leaf tobacco and all other manufactured tobacco have been added together.
[c] The figures for 1936 are for ten months only, January to October.

TABLE 18(*b*).—*Exports to the United States of tobacco and tobacco products*

Year	Scraps, stripped filler and cigar ends		Smoking or cut tobacco			All other
	Quantity	Value	Quantity	Value	Quantity	Value
	Kilos	*Pesos*	*Kilos*	*Pesos*	*Kilos*	*Pesos*
1909 [a]						
1910 [a]						
1911 [a]			10,703	13,544		
1912 [a]			11	26		
1913			40	60		
1914			1,706	2,662		600
1915						
1916	159,780	86,715	57,076	36,369		18,366
1917	1,722,974	1,559,258	1,874	1,155		44,390
1918	2,351,258	2,676,187	180	116		26,152
1919	170,182	143,220				
1920	580,635	406,243	30,905	26,752		
1921	121,764	49,420	5,262	4,497		
1922	624,103	248,005	3,594	1,588		
1923	599,882	286,604	53,723	25,497	140	142
1924	478,954	278,745				
1925	582,346	372,568	398	199		
1926	434,625	287,128	5,676	1,820		
1927	711,657	445,311	1,853	980		
1928	1,985,436	1,008,285			27,600	1,560
1929	1,669,052	765,296	43	52	6,830	93
1930	1,981,552	965,963			13,527	579
1931	1,691,111	945,441	3	4	7,310	1,440
1932	1,292,186	618,619			9,340	3,744
1933	793,959	279,931				
1934	733,053	244,647			300	100
1935	1,370,845	504,006			5	1
1936 [b]	755,383	278,546				
1937						

[a] The figures for 1910 are for six months only, July to December.
[b] The figures for 1936 are for ten months only, January to October.

TABLE 19 (*a*).—*Imports from the United States of tobacco, tobacco products and other articles used in the tobacco industry*

Year	Leaf tobacco		Cigars		Cigarettes	
	Quantity	Value	Quantity	Value	Quantity	Value
	Kilos	*Pesos*	*Number*	*Pesos*	*Number*	*Pesos*
1909	6,930	16,236	----------	354	----------	418
1910 [a]	25,990	98,468	----------	16,254	----------	23,462
1911	6,852	19,614	----------	58	----------	27,538
1912 [b]	6,195	17,584	----------	58	1,814,000	30,738
1913	3,060	7,234	6,250	894	5,094,500	60,546
1914	3,122	18,132	200	40	8,598,352	93,278
1915	6,474	31,774	300	27	12,484,941	125,453
1916	3,445	10,507	2,029	545	13,859,000	148,404
1917	14,446	108,233	50	10	32,778,100	253,117
1918	26,692	229,968	3,100	1,003	59,121,200	460,052
1919	27,428	99,418	----------	----------	71,910,210	654,501
1920	268,624	1,327,236	4,800	117	128,679,903	1,215,110
1921	105,773	570,881	5,700	181	230,538,821	2,175,269
1922	35,903	135,941	375	37	154,764,650	1,101,712
1923	45,169	274,172	59,950	2,883	190,507,400	1,031,952
1924	100,239	572,823	5,547	133	241,194,371	1,267,429
1925	225,435	894,831	500	42	361,514,989	1,704,690
1926	332,562	1,210,001	100	4	417,936,501	1,920,034
1927	298,780	1,292,166	500	60	542,053,520	2,641,028
1928	359,074	1,707,249	1,003	94	708,957,981	3,267,641
1929	201,532	990,312	----------	----------	1,019,805,620	4,251,289
1930	166,835	608,454	2,940	532	1,075,737,000	4,063,585
1931	348,470	604,705	4,100	930	1,131,929,900	3,816,781
1932	836,562	704,812	78,000	4,807	1,053,483,207	3,889,884
1933	1,665,457	1,126,144	26,195	2,033	762,168,761	2,312,027
1934	566,729	896,218	12,902	1,004	1,488,725,890	4,355,849
1935	193,921	576,612	105	8	2,056,224,343	6,153,235
1936 [c]	242,255	627,346	226	30	1,710,042,899	5,319,432

[a] The figures for 1910 are for six months only, July to December.
[b] The figures for 1912 are for a whole fiscal year ending June 30, 1912.
[c] The figures for 1936 are for ten months only, January to October.

TABLE 19 (*b*).—*Imports from the United States of tobacco, tobacco products and other articles used in the tobacco industry*

Year	Smoking tobacco		Plug and chewing tobacco		All other	
	Quantity	Value	Quantity	Value	Quantity	Value
	Kilos		*Kilos*		*Kilos*	
1909	----------	----------	8,364	₱17,090	----------	₱64,000
1910 [a]	22,124	₱54,194	60,034	101,686	----------	103,794
1911	123,168	176,762	40,102	59,986	----------	38
1912 [b]	132,185	206,170	71,598	102,184	----------	8,672
1913	86,331	212,192	161,206	224,720	----------	76
1914	55,055	129,690	175,132	249,878	----------	68
1915	70,439	166,085	249,905	362,721	----------	34
1916	86,254	201,549	253,375	368,681	----------	101
1917	82,474	197,024	295,659	449,395	----------	258
1918	38,598	108,069	323,123	503,145	----------	220
1919	125,106	387,695	232,738	570,799	----------	----------
1920	54,511	144,014	281,230	519,669	----------	----------
1921	110,028	249,600	344,891	708,485	17	31
1922	141,335	278,352	229,200	512,826	876	516
1923	16,045	69,263	294,243	705,028	183	713
1924	26,494	92,260	333,536	707,947	99	317
1925	25,132	69,961	354,594	731,004	1,478	3,729
1926	12,376	46,288	357,182	758,115	273	895
1927	14,967	46,590	448,792	948,346	122	403
1928	21,092	34,305	465,667	1,000,761	289	862
1929	15,957	44,139	465,661	1,016,269	94	402
1930	17,473	44,440	400,003	890,125	222	650
1931	17,574	47,967	405,949	867,368	24	192
1932	20,742	45,357	295,000	607,440	552	1,636
1933	15,741	39,071	319,944	677,656	29,482	12,323
1934	11,506	28,718	201,870	432,139	6,265	729
1935	37,679	80,404	272,844	577,928	5,774	4,986
1936 [c]	17,863	41,034	146,727	335,416	310	1,065
1937 [c]	----------	----------	----------	----------	----------	----------

[a] The figures for 1910 are for six months only, July to December.
[b] The figures for 1912 are for a whole year ending June 30, 1912.
[c] The figures for 1936 are for ten months only, January to October.

TABLE 19 (*c*).—*Imports from the United States of tobacco, tobacco products and other articles used in the tobacco industry*

Year	Cigarette paper		Cellophane		Lithographs, labels, flaps, bands, wrappers and cigarbox		Cigarettes and other tobacco machinery	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
	Kilos	*Pesos*	*Kilos*	*Pesos*		*Pesos*		*Pesos*
1909	--------	--------	--------	--------	--------	--------	--------	--------
1910	--------	--------	--------	--------	--------	--------	--------	--------
1911	--------	--------	--------	--------	--------	--------	--------	--------
1912	--------	--------	--------	--------	--------	--------	--------	--------
1913	882	1,284	--------	--------	--------	24,002	--------	--------
1914	2,587	3,346	--------	--------	--------	26,302	--------	--------
1915	3,773	4,363	--------	--------	--------	21,459	--------	--------
1916	3,730	6,017	--------	--------	--------	28,413	--------	499
1917	10,322	34,887	--------	--------	--------	62,040	--------	1,826
1918	2,681	9,403	--------	--------	--------	252,363	--------	486
1919	5,715	21,988	--------	--------	--------	265,339	--------	56,303
1920	7,751	32,544	--------	--------	--------	311,830	--------	141,772
1921	54,600	80,654	--------	--------	--------	437,326	--------	132,339
1922	2,955	9,780	--------	--------	--------	133,934	--------	44,340
1923	16	16	--------	--------	--------	190,478	--------	10,482
1924	376	683	--------	--------	--------	189,399	--------	4,549
1925	--------	--------	--------	--------	--------	144,871	--------	30,669
1926	260	456	--------	--------	--------	104,786	--------	10,191
1927	434	1,899	--------	--------	--------	67,210	--------	16,857
1928	302	850	--------	--------	--------	100,220	--------	4,791
1929	102	214	--------	--------	--------	46,529	--------	10,619
1930	84	180	--------	--------	--------	73,000	--------	20,617
1931	--------	--------	--------	--------	--------	55,976	--------	139,276
1932	240	215	--------	--------	--------	9,331	--------	62,857
1933	12,082	12,979	119,922	271,134	--------	2,509	--------	102,310
1934	6,604	11,414	143,143	308,442	--------	36,056	--------	144,326
1935	1,247	1,570	125,286	224,307	--------	19,831	--------	13,537
1936	--------	--------	--------	--------	--------	--------	--------	13,669
1937	--------	--------	--------	--------	--------	--------	--------	--------

The figures for 1936 are for ten months only, January to October.

TABLE 20.—*Exports to the United States in retail*

Year	Number of cigars exported	Average price per 1,000
1918	265,234,126	₱43.68
1919	261,514,367	53.14
1920	321,616,983	65.16
1921	73,303,964	55.25
1922	174,186,363	49.01
1923	219,702,360	52.25
1924	185,536,675	56.98
1925	212,873,752	47.76
1926	205,995,581	47.04
1927	173,190,208	43.29
1928	187,360,260	42.01
1929	156,641,727	40.85
1930	154,134,414	39.43
1931	166,193,165	36.34
1932	176,259,204	34.45
1933	185,056,249	30.52
1934	208,268,782	31.10
1935	208,676,183	29.99
1936	164,905,078	30.28
1937	---	---

TABLE 21.—*Estimation of wrappers used for cigars sent to the United States*

Year	Total number of cigars	With U. S. wrappers	With Sumatra wrappers	With Philippine wrappers
		Per cent	*Per cent*	*Per cent*
1918	265,234,126	.65	1.57	97.78
1919	261,514,367	2.00	2.75	95.25
1920	321,616,983	1.00	3.05	95.25
1921	73,303,964	2.85	3.00	94.15
1922	174,186,363	2.00	2.55	95.45
1923	219,702,360	4.25	3.75	92.00
1924	185,436,675	8.35	2.65	89.00
1925	212,873,752	10.50	2.15	87.35
1926	205,995,581	54.67	1.12	44.21
1927	173,190,208	45.05	1.86	53.09
1928	187,360,260	56.72	.76	42.52
1929	156,641,727	41.50	3.70	54.80
1930	154,134,414	37.69	2.98	59.33
1931	166,193,165	39.54	2.58	57.88
1932	176,259,204	48.13	1.63	50.24
1933	185,056,249	56.48	2.01	41.51
1934	208,268,782	75.75	.22	24.03
1935	208,676,183	78.14	.25	21.61
1936	164,905,078	82.71	1.38	16.91
1937	---	---	---	---

TABLE 22.—*Bulk of trade in the United States built on class A cigars.*

Class	Tax per M.	1932	1933	1934	1935	1936
		Number	*Number*	*Number*	*Number*	*Number*
A	$2.00	175,295,494	184,733,304	207,571,212	208,181,968	164,317,208
B	3.00	686,730	166,990	516,695	299,965	322,330
C	5.00	236,450	152,955	178,275	160,170	129,930
D	10.50	800	800	600	32,830	129,860
E	13.50	39,730	2,200	2,000	1,250	5,750

TABLE 23.—*Tobacco trade in the United States not entirely confined to the exportation of cigars.*

CIGARS

Quarter	1932	1933	1934	1935	1936
	Number	*Number*	*Number*	*Number*	*Number*
First	39,262,058	30,191,261	55,781,951	53,711,912	38,410,167
Second	39,312,145	30,675,410	55,176,473	48,215,685	42,068,417
Third	50,944,154	54,468,050	33,242,881	52,321,200	46,141,548
Fourth	46,740,847	69,721,528	64,067,477	54,427,386	38,284,946
Total	176,259,204	185,056,249	208,268,782	208,676,183	164,905,078

CIGARETTES

Quarter	1932	1933	1934	1935	1936
	Number	*Number*	*Number*	*Number*	*Number*
First	293,830	670,800	548,300	419,900	115,000
Second	292,700	221,100	700,200	519,650	197,000
Third	306,420	218,450	195,500	351,450	180,000
Fourth	490,100	454,000	461,600	395,000	251,000
Total	1,382,050	1,564,350	1,906,600	1,686,000	743,000

PARTIALLY MANUFACTURED TOBACCO

Quarter	Stripped tobacco	Scrap tobacco	Stripped tobacco	Scrap tobacco	Stripped tobacco	Scrap tobacco
	1932		1933		1934	
	Kilos	*Kilos*	*Kilos*	*Kilos*	*Kilos*	*Kilos*
First	315,682	229,362	113,541	72,214	119,494	81,132
Second	264,813	174,900	53,226	66,755	99,646	71,287
Third	161,865	110,830	54,544	200,681	35,235	60,596
Fourth	126,030	91,357	133,083	156,108	88,065	204,612
Total	868,390	606,449	354,394	495,758	342,440	417,627

Partially manufactured tobacco—Continued

Quarter	Stripped tobacco	Scrap tobacco	Stripped tobacco	Scrap tobacco
	1935		1936	
	Kilos	*Kilos*	*Kilos*	*Kilos*
First	91,588	332,003	101,555	100,097
Second	167,633	161,462	116,729	181,038
Third	91,419	196,509	111,193	94,350
Fourth	95,249	219,116	111,296	175,288
Total	445,889	909,090	440,773	550,773

TABLE 24.—*Imports per capita*

Year	Value	Per capita	Per cent of total imports	Increase (+) or decrease (—) over preceding year
	Pesos			*Per cent*
1903	27,142	(a)	(b)	
1928	6,202,070	0.49	2	+11
1929	6,541,455	.50	2	+ 5
1930	5,887,775	.44	2	— 9
1931	5,443,428	.40	3	— 7
1932	5,386,142	.39	3	— 1
1933	4,240,219	.30	3	— 21
1934	5,853,802	.45	4	+38
1935	7,500,559	.57	4	+28
1936	7,130,860	.54	4	— 5
1937				

[a] Less than one half of a centavo. [b] Less than one half of 1 per cent.

TABLE 25.—*Philippine tobacco imports by countries*

Imported from—	1936		1935	
	Value	Per cent	Value	Per cent
	Pesos		*Pesos*	
United States	7,031,197	98.60	7,392,173	98.55
Dutch East Indies	88,314	1.24	92,128	1.23
China	1,782	.03	3,915	.06
Total	7,130,860	100.00	7,500,559	100.00

TABLE 26.—*Philippine tobacco exports per capita*

Year	Value	Per capita	Per cent of total	Increase (+) or decrease (—) over preceding year
	Pesos			*Per cent*
1903	3,893,750	0.51	6	----------
1928	17,142,873	1.36	5	— 4
1929	17,379,888	1.37	5	+ 5
1930	15,672,771	1.19	5	—11
1931	14,841,675	1.11	7	— 5
1932	12,800,118	.94	7	—14
1933	10,355,787	.74	5	—19
1934	10,389,407	.80	5	([a])
1935	12,003,658	.92	6	+16
1936	10,489,586	.79	4	—13
1937	----------	----------	----------	----------

[a] Increase of less than one half of 1 per cent.

Exported to—	1936		1935	
	Value	Per cent	Value	Per cent
	Pesos		*Pesos*	
United States	5,124,090	48.85	6,577,130	54.79
Spain	2,965,089	28.18	3,177,450	26.47
Italy	402,391	3.84	2,119	.02
France	387,412	3.69	173,133	1.44
Korea	334,506	3.19	739,662	6.16
Japan	277,622	2.65	334,428	2.79
China	275,408	2.63	288,400	2.40
Hawaii	212,031	2.03	205,688	1.71
Hongkong	96,925	.92	93,455	.78
British East Indies	91,730	.87	89,185	.74
Other countries	330,753	3.15	323,008	2.70
Total	10,489,566	100.00	12,003,658	100.00

TABLE 27(*a*).—*Imports from January 1 to June 30*

	1936		1937	
	Quantity	Value	Quantity	Value
Leaf tobacco:	*Kilos*	*Pesos*	*Kilos*	*Pesos*
United States	174,394	415,027	273,071	249,224
Dutch East Indies	2,006	22,654	3,346	29,310
	176,490	437,681	276,417	278,534
Cigars:	*Number*		*Number*	
United States	200	20	6,210	190
Cuba	420	26	-----	-----
	620	46	6,210	190
Cigarettes:	*Number*		*Number*	
United States	913,971,904	2,865,102	995,484,280	3,170,084
Austria	100	2	1,000	8
China	6,800	147	6,300	162
Germany	-----	-----	10,000	100
Hongkong	16,450	260	19,720	403
	913,995,254	2,865,511	995,521,300	3,170,757
Chewing:	*Kilos*		*Kilos*	
United States	81,962	197,680	162,325	347,609
Smoking:	*Kilos*		*Kilos*	
United States	10,772	24,350	13,333	32,139
Great Britain	21	130	50	326
China	2,899	4,450	2,488	3,968
Netherlands	2	6	-----	-----
Switzerland	1	1	-----	-----
Hongkong	39	423	75	750
Japan	1	1	-----	-----
	13,735	29,361	15,946	37,183
All other:	*Kilos*		*Kilos*	
United States	279	965	175	560
Totals:				
Leaf tobacco ------- Ks.	176,490	437,681	276,417	278,534
Cigars ------- No.	620	46	6,210	190
Cigarettes ------- No.	913,995,254	2,865,511	995,521,300	3,170,757
Chewing ------- Ks.	81,962	197,680	162,325	347,609
Smoking ------- Ks.	13,735	29,361	15,946	37,183
All other ------- Ks.	279	965	175	569
Total	-----	5,531,244	-----	3,834,842

TABLE 27(*b*).—*Exports from January 1 to June 30*

	1936		1937	
	Quantity	Value	Quantity	Value
	Kilos	*Pesos*	*Kilos*	*Pesos*
Leaf tobacco:				
United States	200	106		
Other countries	6,989,585	2,726,565	5,232,708	1,815,197
	6,989,785	2,726,671	5,232,708	1,815,197
	Number		*Number*	
Cigars:				
United States	79,987,282	2,373,659	74,464,241	2,190,585
Other countries	9,524,065	373,510	13,125,432	442,252
	89,511,347	2,747,169	87,589,673	2,632,837
	Number		*Number*	
Cigarettes:				
United States	279,450	2,392	365,560	3,510
Other countries	6,109,840	12,939	4,659,010	9,628
	6,389,290	15,331	5,024,570	13,138
	Kilos		*Kilos*	
Scraps, stripped filler and cigar end:				
United States	494,355	177,958	1,333,228	623,655
Other countries	46,180	15,724	74,530	28,892
	540,535	193,682	1,407,758	652,547
	Kilos		*Kilos*	
Smoking or cut tobacco:				
United States				
Other countries	769	663	817	671
	769	663	817	671
	Kilos		*Kilos*	
All other:				
United States				
Other countries	45,959	2,728	55,596	1,441
	45,959	2,728	55,596	1,441
	Kilos		*Kilos*	
Totals:				
Leaf tobacco	6,989,785	2,726,671	5,232,708	1,815,197
Cigars No.	89,511,347	2,747,169	87,589,673	2,632,837
Cigarettes No.	6,389,290	15,331	5,024,570	13,138
Scraps, stripped filler and cigar end Ks.	540,535	193,682	1,407,758	652,547
Smoking or cut tobacco No.	769	663	817	671
All other Ks.	45,959	2,728	55,596	1,441
Total		5,686,244		5,115,831

TABLE 28.—*Proportion of local materials used in the manufacture of cigars and cigarettes*

Year	Local production of cigarettes	Imported cigarettes	Imports
	Number	*Number*	*Per cent*
1928	5,110,187,247	708,957,981	13.87
1930	4,718,684,523	1,075,737,000	22.79
1932	3,953,734,473	1,053,483,207	26.64
1934	2,986,494,142	2,056,224,343	50.18
1935	2,986,494,142	2,056,224,343	68.85
1936	3,071,244,827	1,893,867,719	61.66

Year	With U. S. wrappers	With Sumatra wrappers	With Philippine wrappers
	Per cent	*Per cent*	*Per cent*
1918	0.65	1.57	97.78
1925	10.50	2.15	87.35
1935	78.14	0.25	21.61
1936	82.71	1.38	16.91

TABLE 29.—*Cost of manufacture (per thousand cigars)*

United States internal revenue tax	₱ 4.00
Packing and shipping expenses	4.50
Leaf tobacco Philippine Islands filler and binder	4.10
Leaf tobacco wrapper Georgia or Florida	4.00
Cigar-maker's wage	4.50
Preparing materials Filler strippers Wrapper strippers	1.50
Cigar boxes	0.95
Paper and labels	0.80
Labellers (Presenteros) Boxers (Envasadores)	0.65
Cellophaning and bundling by machine (material and labor)	1.40
	₱26.40
Balance left for overhead, interest and margin of profit	₱2.60
Total	₱29.00

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APPENDIX A

SUMATRA METHOD OF FERMENTING CIGAR WRAPPER TOBACCO

The fermentation of a regular big crop of wrapper leaves from a single estate in the island of Sumatra is done in a series of gradual combinations of the fermenting piles or mandalas which are initially of small size. For convenience, let us call the series: A, B, C, and D. Each step in the series as a rule is characterized as to size and temperature allowed in each as follows:

A Series (first piles).—About 1,000 to 2,000 kilos of leaves are piled into bulks of 2.5 by 2.5 meters by about 30 layers and the temperature allowed is from 48° to 50° C. within 9 days.

B Series (second piles).—Each pair of A piles is now combined forming 3 by 3 meters by about 33 layer bulks with about 2,000 to 4,000 kilos of leaves and the temperature allowed to rise to 50° to 54° C.

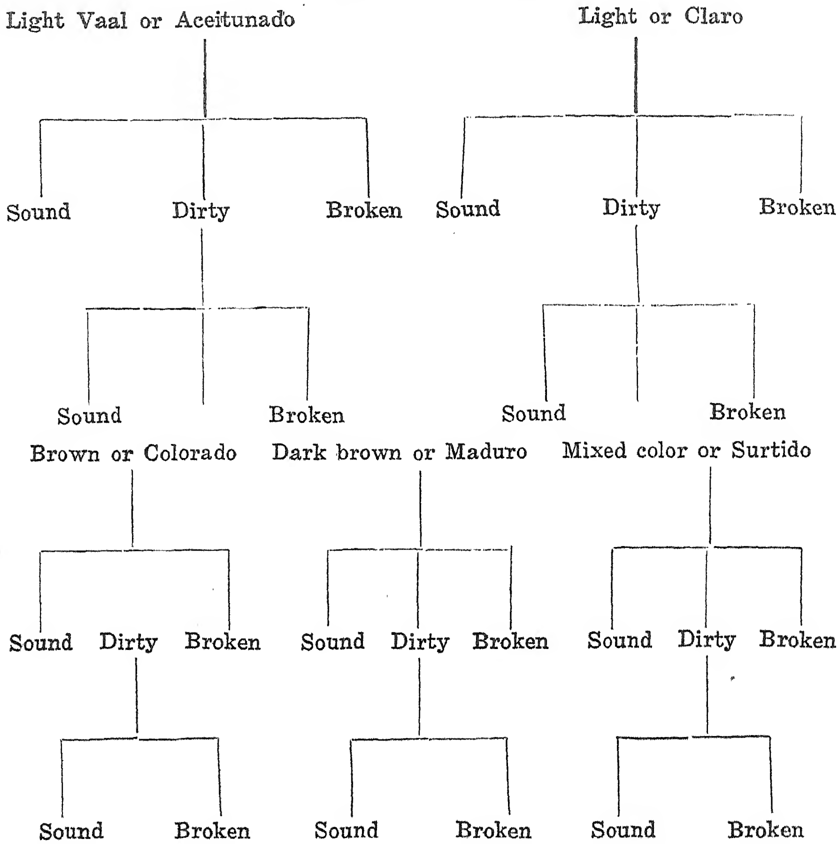
C Series (third piles).—Each pair of B piles is at this stage combined also, forming 4½ by 3 meters by about 40 layer bulks and the temperature further allowed to rise 54°–58° C.

D Series (fourth and last piles).—Lastly, each pair of C piles is combined to form 4.5 by 4.5 meters by about 50 layers or 3.75 by 5 meter bulks. The maximum temperature of 56° to 58° C is the limit allowed to develop in this series.

Because of the tremendous size of the crop, many piles are naturally made under each series. And the piles under the first or A series are designated thus: A–1, A–2, A–3, A–4, etc. The whole process may last from 45 to 75 days.

Appendix B

DIAGRAM OF PROPOSED WRAPPER TOBACCO CLASSIFICATION



Abbreviations:

Lv	Light vaal or aceitunado.
L	Light or claro.
B	Brown or colorado.
BB	Dark brown or maduro.
S	Mixed color or surtido.
X	Sound.
Y	Dirty.
Z	Broken.

Classification as to length:

First	15 inches or more.
Second	12 inches and less than 15 inches.
Third	10 inches and less than 12 inches.
Fourth	8 inches and less than 10 inches.
Fifth	all leaves below 8 inches.

Appendix C

CLASSIFICATION AND BALING OF SUMATRA WRAPPERS

Sumatra wrappers are first classified according to color and soundness as follows:

Dutch abbreviations or markings	English descriptions
L	Very light brown
LB	Light brown
LL	Light brown, slightly speckled
BBL	Light brown, speckled
V	Fallow (mousy brown)
LV	Light fallow—the most prized color
VV	Dark fallow
SV	Fallow, slightly speckled
B	Brown
SB	Brown, partly speckled
BB	Brown, speckled
D	Dark brown
SD	Dark brown, slightly speckled and broken
BD	Dark brown, speckled
K	Assorted, clean but lifeless
SK	Assorted, dirty and lifeless
KL	Light but lifeless
X	Broken or worm-eaten
XX	Badly broken
O	Discarded, trash and refuse

After the color classification, the leaves are sorted according to four sizes only. There are no standard lengths but the crop of each year is sorted into four sizes for convenience. Consequently, when the year is favorable, the first size-class may be much longer than the same class of an unfavorable year. As a rule, however, the leaves may fall within 15-, 25-, 30-, 38-, and 46–centimeter lengths.

After sorting, the leaves are rebundled into 35 or 40 in each bundle, after which, they are ready to be pressed and baled.

The baling apparatus used in Sumatra is the same as that used in the Philippines, but the methods of arranging the leaves in the bales as well as the general handling of the apparatus are markedly different. Without counting the number of the bundles, a lot weighing 80 kilograms is placed in a collapsible wooden receptacle 30 inches square and over 2 feet high and this slides under the press on rollers. Pieces of tightly woven pandan mattings are placed above then below the receptacle after the bundles have been put in, with the petioles pointing outward. The receptacle is then placed exactly under the press, the iron cover is lowered, the sides are removed, and pressing is continued until the bale has been squeezed to about a foot in height only. Bales of Sumatra tobacco are of uniform size, that is, 30 by 30 inches by 9 to 12 inches in height, depending on the size of the leaves to be baled. The bigger the size the higher the bale.

When the desired height of the bale has been reached, the matting at the top and bottom are pulled together and sewed up. The bale is removed, marked with the grade and other identification marks and is ready for shipping. The method of regulating the pressure exerted in the baling of tobacco as observed in Sumatra and in Cuba undoubtedly is a very sound practice. The leaves are not deprived entirely of the necessary moisture for maintaining the so-called "life" of sound cigar tobacco in general and of wrapper tobacco in particular.

The bales of Sumatra tobacco are usually marked thus—

BK/1917/4/XLV/3

BK stands for the sign or mark of the estate in which the crop was raised.

1917 stands for the year of the crop.

4 stands for the shipment series (that is, the 4th shipment).

XLV stands for broken leaves of light fallow color.

3 means that the size of the leaves is that of the 3rd group.

Appendix D

CLASSIFICATION AND BALING OF SHADE-GROWN TOBACCO IN CUBA

Classification.—The sound leaves par excellence are sorted out according to size into three main groups which in turn are subdivided into three main kinds of fineness.

A. First—1a/10a, S(Dry), 1a/10a, F (fine), and 1a/10a, Mt. (medium).
Second—1a/ 12a, S (Dry), 11a/12a F (fine), and 11a/10a, Mt. (medium).
Third—13a, S(dry), 13a/F(fine), and 13a/Mt. (Medium).

There is no exact standard for size because the size of any one leaf depends on the season. Suffice it to say that the first group represents the largest, which are about 50 cm. in length, and the last represents the smallest of the most perfect and sound wrappers (from 1a/to 15a). "S" is the abbreviation for *seco* or *Ligero,* "F" for *Fina* and "Mt." for *Medio Tiempo.*

B. Leaves of the same sizes as above but which, due to some flaw or other, cannot be included in any of the A sets. They are designated as *Rezagos.*

1st–1a/3a. Rgo. 1a/S. Rgo. 1a/F. Rgo. 1a/Mt.
2nd–4a/Rgo. 2a/S. Rgo. 2a/F. Rgo. 2a/Mt.
3rd–5a/Rgo. 3a/S. Rgo. 3a/F. Rgo. 3a/Mt.

C. Besides these, there are two other *Rezago* classes designated as Rgo. 6a/7a that include the leaves not up to the 1a/5a class.

D. Still further extra grade, which is suitable as binder either as 14a/F. and 14a/S. or 16a/Rgo.

E. Likewise a clean grade of filler known as 15a/ or 16a/.

F. A type of filler known as *dispalillable* is also separated and is designated 16a/–12a/.

G. Two grades known as *Volados* are obtained:

Volado No. 1 includes all large leaves which are chaffy greenish (*volado, verdosa, sin vida y vaciada*). These can be fixed up so that they can be used for filler. A leaf may supply enough tobacco for a cigar.

Volado No. 2 includes similar but decidedly small leaves.

Volado No. 1 is usually discarded from the larger classes and should be inferior to Rgo. 1a/. Volado No. 2 is discarded from the filler grade 17a/.

H. A filler grade of coarser texture is separated from the ordinary filler grades, 15a/16a and is called 15a/ *de calidad.*

I. Two grades known as *Quebrados*:

Quebrado No. 1 consists of heavier or rougher leaves Rgo. 4a/5a.

Quebrado No. 2 consists of leaves under the same conditions but derived from other than preceding. It is distinguished from the *volados* in that the latter are of lighter texture.

J. Two grades known as *Sentidos:*
Sentido No. 1—Large partly decayed leaves.
Sentido No. 2—Small partly decayed leaves.

K. Two grades of clear-cut yellow or very pale leaves:
Amarillo No. 1 (large) and Amarillo No. 2 (small).

L. *Bote* includes all that cannot be classified with any of the above.

TABLE 1.—*Number of leaves in each hand*

Representative grades	Number of leaves
1a/10a–Rgo. 1a	35
11a/12a–Rgo. 2a	40
13a/Rgo. 3a	45
14a/Rgo.	60
Rgo. 4a	50
Rgo. 5a	55
Qdo. 1a	50
Qdo. 2a	55
Volado 1a	40
Volado 2a ....In *gavillas* (¼) of a hand *bultos*	
15/16a ....8 ounces *gavilla*	
1a ....Baled in *gavillas* without being bundled into manojos.	

TABLE 2.—*Classification terms and equivalents*

1 *Tercio* = 50 *cujes* (poles) in *mancuernas* (pair of grown leaves harvested with stalk).
2 *Tercio* = 110 *cujes* of primed leaves.
1 *Tercio* = 550 *cujitos* (short poles) of primed leaves.
1 *Tercio* = 80 *manojos* (hand).
1 *Manojo* = 4 *gavillas*.
1 *Gavilla* = 33 to 60 leaves of wrapper or binders.
1 *Gavilla* = 6 oz. leaves of fillers.

Baling.—After the leaves have been classified, they are rebundled or retied into hands according to table 1. A hand is tied with raffia fiber which is wound around it spirally so that it becomes fusiform in shape. The hand at the base of the leaves is tied with one of the leaves constituting the hand itself. The hands are then ready to be baled right away. As a rule when the weather permits, the classified leaves are baled the same day.

The baling apparatus is a simple thing. It consists of flat, rather heavy boards 2.5 meters long supported at the middle of its sides by heavier narrow boards 1.5 meters long. These are connected below the base board by two flat, thinner boards which pass through one side of the apparatus according to the size of bales to be made. At one end of the connecting boards are set alternately half a dozen holes for the purpose. The connecting boards are 1.2 meters long. On the top of the sideboards are 4 slightly tapering small supports which are 15 centimeters apart. Between these supports are a pair of sticks to hold the string for tying the bundle. These supports are 60 centimeters high and 4.5 centimeters square at the top. The two centers have removable sticks with which

to hold firmly a broad petiole of the royal palm (*Roystonia regea* Cook) which is the material used exclusively in the baling of tobacco leaves in Cuba. The rope used to tie the bales is derived from the fibrous cortex of a malvaceous plant commonly known as majoguar (*Hibiscus tiliaceous* Linn.). Four pieces of royal palm petioles are required ordinarily for packing a bale of Cuban tobacco. A piece of these petioles is usually 1 meter by 1.5 meters. As these materials are very strong and very compact, they are ideal for the purpose, besides being cheap and abundant.

A bale always contains only 80 hands irrespective of its grade. The hands are arranged in two layers with the butts of the leaves pointing towards the ends of the bales. The upper and lower layers contain 13 hands each and the central layers 14 hands.

The main feature of this process lies in that the leaves are not actually pressed by machinery. Only hand pressure is employed. This method is very sensible inasmuch as the moisture which is vital in the conservation of the so-called "life" of the leaf tobacco is not squeezed out. It is possible that the pressing of Philippine tobacco to the limit, it is ventured to say, by the use of powerful mechanical apparatus, is responsible for the deficiency of aroma and flavor so justly complained about by American jobbers, and smokers. Indeed, practically all Philippine leaf tobacco examined by the senior writer while in New York City is wanting in the elastic or pliable property which is an obvious indication that a leaf is not "dead" but "alive."

Appendix E

STANDARD GRADES OF THE CONNECTICUT HAVANA SEEDLEAF AND BROADLEAF

(Prepared by the Tobacco Standardization Section, United States Department of Agriculture)

I. STANDARD GRADES FOR CONNECTICUT HAVANA SEED—TYPE 51

Key to Grade Marks

Groups	Qualities	Colors	Lengths 75 per cent Size between
A—Wrappers	1—1st quality	L—Light	15–14″ to 16″
B—Second or binders	2—2nd quality	C—Chestnut	17–16″ to 18″
C—Tops and fillers	3—3rd quality	or medium	19–18″ to 20″
X—Brokes and nondescript	4—4th quality	D—Dark	21–20″ to 22″
Y—Stemmers	9—Wet tobacco	M—Mixed colors	23–22″ to 24″
			25–24″ to 26″
			27–26″ to 28″

Damaged Tobacco

All damaged tobacco to be marked to show the kind and the percentage (or amount) of damage, after the grade designation. For example A2 L25 Black rot 6 layers.

First Factor Group	Second Factor Qualities	Third Factor Colors	Fourth Factor Length or sizes
A	1, 2, and 3	L, C, and D	27, 25, 23, 21, 19, 17
B	1, 2, 3, and 9	L and D	27, 25, 23, 21, 19, 17, 15
C	1, 2, and 9	No color mark	No length designated
X	1, 2, 3, and 9	No color mark	No length designated

LIST OF CONNECTICUT HAVANA SEED GRADES

Light Wrappers (A Group)

Standard Grade	Description of Grades	Old Grade Mark	
A 1 L 27	Choice quality—26″ to 28″	Light wrapper 28″	Pool 1
A 1 L 25	Choice quality—24″ to 26″	Light wrapper 26″	Pool 1
A 1 L 23	Choice quality—22″ to 24″	Light wrapper 24″	Pool 1
A 1 L 21	Choice quality—20″ to 22″	Light wrapper 22″	Pool 1
A 1 L 19	Choice quality—18″ to 20″	Light wrapper 20″	Pool 1
A 1 L 17	Choice quality—16″ to 18″	Light wrapper 18″	Pool 1
A 2 L 27	Good quality—26″ to 28″	Light wrapper 28″	Pool 2
A 2 L 25	Good quality—24″ to 26″	Light wrapper 26″	Pool 2
A 2 L 23	Good quality—22″ to 24″	Light wrapper 24″	Pool 2
A 2 L 21	Good quality—20″ to 22″	Light wrapper 22″	Pool 2
A 2 L 19	Good quality—18″ to 20″	Light wrapper 20″	Pool 2
A 3 L 27	Fair quality—26″ to 28″	Light wrapper 28″	Pool 3
A 3 L 25	Fair quality—24″ to 26″	Light wrapper 26″	Pool 3
A 3 L 23	Fair quality—22″ to 24″	Light wrapper 24″	Pool 3
A 3 L 21	Fair quality—20″ to 22″	Light wrapper 22″	Pool 3
A 3 L 19	Fair quality—18″ to 20″	Light wrapper 20″	Pool 3

Medium Wrappers (A Group)

A 1 C 27	Choice quality—26″ to 28″	Med. wrapper 28″	Pool 1
A 1 C 25	Choice quality—24″ to 26″	Med. wrapper 26″	Pool 1
A 1 C 23	Choice quality—22″ to 24″	Med. wrapper 24″	Pool 1
A 1 C 21	Choice quality—20″ to 22″	Med. wrapper 22″	Pool 1
A 2 C 27	Good quality—26″ to 28″	Med. wrapper 28″	Pool 2
A 2 C 25	Good quality—24″ to 26″	Med. wrapper 26″	Pool 2
A 2 C 23	Good quality—22″ to 24″	Med. wrapper 24″	Pool 2
A 2 C 21	Good quality—20″ to 22″	Med. wrapper 22″	Pool 2
A 3 C 27	Fair quality—26″ to 28″	Med. wrapper 28″	Pool 3
A 3 C 25	Fair quality—24″ to 26″	Med. wrapper 26″	Pool 3
A 3 C 23	Fair quality—22″ to 24″	Med. wrapper 24″	Pool 3
A 3 C 21	Fair quality—20″ to 22″	Med. wrapper 22″	Pool 3

Dark Wrappers (A Group)

A 1 D 27	Good quality—26″ to 28″	Dark wrapper 28″	Pool 1
A 1 D 25	Good quality—24″ to 26″	Dark wrapper 26″	Pool 1
A 1 D 23	Good quality—22″ to 24″	Dark wrapper 24″	Pool 1
A 1 D 21	Good quality—20″ to 22″	Dark wrapper 22″	Pool 1
A 2 D 27	Fair quality—26″ to 28″	Dark wrapper 28″	Pool 2
A 2 D 25	Fair quality—24″ to 26″	Dark wrapper 26″	Pool 2
A 2 D 23	Fair quality—22″ to 24″	Dark wrapper 24″	Pool 2
A 2 D 21	Fair quality—20″ to 22″	Dark wrapper 22″	Pool 2

Seconds or Binders (B Group)

B 1 L 27	Choice quality light—26″ to 28″	Seconds 28″	Pool 1
B 1 L 25	Choice quality light—24″ to 26″	Seconds 26″	Pool 1
B 1 L 23	Choice quality light—22″ to 24″	Seconds 24″	Pool 1
B 1 L 21	Choice quality light—20″ to 22″	Seconds 22″	Pool 1
B 1 L 19	Choice quality light—18″ to 20″	Seconds 20″	Pool 1
B 1 L 17	Choice quality light—16″ to 18″	Seconds 18″	Pool 1
B 1 L 15	Choice quality light—14″ to 16″	Seconds 16″	Pool 1
B 2 L 27	Good quality light—26″ to 28″	Seconds 28″	Pool 2
B 2 L 25	Good quality light—24″ to 26″	Seconds 26″	Pool 2
B 2 L 23	Good quality light—22″ to 24″	Seconds 24″	Pool 2
B 2 L 21	Good quality light—20″ to 22″	Seconds 22″	Pool 2
B 2 L 19	Good quality light—18″ to 20″	Seconds 20″	Pool 2
B 2 L 17	Good quality light—16″ to 18″	Seconds 18″	Pool 2
B 2 L 15	Good quality light—14″ to 16″	Seconds 16″	Pool 2
B 2 L 27	Fair quality light—26″ to 28″	Seconds 28″	Pool 3
B 2 L 25	Fair quality light—24″ to 26″	Seconds 26″	Pool 3
B 2 L 23	Fair quality light—22″ to 24″	Seconds 24″	Pool 3
B 2 L 21	Fair quality light—20″ to 22″	Seconds 22″	Pool 3
B 2 L 19	Fair quality light—18″ to 20″	Seconds 20″	Pool 3
B 2 L 17	Fair quality light—16″ to 18″	Seconds 18″	Pool 3
B 2 L 15	Fair quality light—14″ to 16″	Seconds 16″	Pool 3

Dark Binders (B Group)

B 1 D 19	Good quality dark binder—18″ to 20″	Dark wrapper 20″	Pool 1

Fillers and Tops (C Group)

C 1 D 21	Good quality dark—20″ to 22″	Dark wrapper 22″	Pool 2
C 1 D 19	Good quality dark—18″ to 20″	Dark wrapper 20″	Pool 2
C 1 D 17	Good quality dark—16″ to 18″	Dark wrapper 18″	Pool 1
C 1 D 15	Good quality dark—14″ to 16″	Dark wrapper 16″	Pool 1
C 2 D 17	Good quality dark—16″ to 18″	Dark wrapper 18″	Pool 2
C 2 D 15	Good quality dark—14″ to 16″	Dark wrapper 16″	Pool 2

Brokes or Nondescript (X Group)

X 1	Good Quality Clean Broken
X 2	Fair Quality Clean Broken
X 3	Common Quality Clean Broken

Stemmers (Y Group)

Y 1	Good Clean Ground Leaves	Fillers
Y 2	Fairly Clean Ground Leaves	Fillers
Y 3	Common and Dirty Ground Leaves	Fillers

Wet Tobacco (Mixed Groups)

B 9	Wet—Pick for Binders (Best Wet)	Wet
C 9	Wet—Pick for Fillers (Medium Quality Wet)	Wet
X 9	Wet—Low Grade or Stemming and Nondescript (Common)	Wet

SUMMARY OF CONNECTICUT HAVANA SEED GRADES—TYPE 51

Wrappers (A Group)

A 1 L	27 25 23 21 19 17	Choice Quality Light Wrapper
A 2 L	27 25 23 21 19	Good Quality Light Wrapper
A 3 L	27 25 23 21 19	Fair Quality Light Wrapper
A 1 C	27 25 23 21	Choice Quality Medium Wrapper
A 2 C	27 25 23 21	Good Quality Medium Wrapper
A 3 C	27 25 23 21	Fair Quality Medium Wrapper
A 1 D	27 25 23 21	Good Quality Dark Wrapper
A 2 D	27 25 23 21	Fair Quality Dark Wrapper

Fillers and Tops (C Group)

C 1 D	21 19 17 15	Good Quality dark fillers
C 2 D	17 15	Fair Quality dark fillers

Brokes or Nondescript (X Group)

X 1	Good quality clean brokes
X 2	Fair quality clean brokes
X 3	Common quality clean brokes

Stemmers (Y Group)

Y 1	Good quality clean stemmers
Y 2	Fairly clean stemmers
Y 3	Common and dirty stemmers

Wet Tobacco (Mixed Groups)

B 9	Wet—Pick for binders (Best Wet)
C 9	Wet—Pick for Fillers (Medium Quality Wet)
X 9	Wet—Low Grade or Stemming and Nondescript (Common)

These grades were prepared by the Tobacco Standardization Section of the U. S. Department of Agriculture on August 28, 1923.

II. STANDARD GRADES FOR CONNECTICUT BROADLEAF—TYPE 52

Strain 521	John Williams	Strain 523	Hockman
Strain 522	Bantle	Strain 524	Barber

Key to Grade Marks

A—Wrappers	1—1st Quality	L—Light
B—Seconds or Binders	2—2nd Quality	C—Chestnut or Medium
C—Tops or Fillers	3—3rd Quality	D—Dark
X—Brokes and Nondescript	4—4th Quality	M—Mixed Colors
Y—Stemmers	9—Wet Tobacco	

Lengths

	Leaves Averaging in Length: Size	Between
Lengths not considered except in short	43	12″ to 16″
Seconds which are indicated by numbers	44	16″ to 20″
	45	20″ to 24″

Damaged Tobacco

All damaged tobacco to be marked to show the kind and the percentage (or amount) or damage, after the grade designation. For example, A2L Black-rot, 6 layers.

Qualities, Colors, and Lengths in Each Group

First Factor Group	Second Factor Qualities	Third Factor Colors	Fourth Factor Lengths or sizes
A	1, 2, 3 and 4	L, C, and D	No length designated
B	1, 2, 3 and 9	L and D	44 and 43
C	1, 2, 3 and 9	D	No length designated
X	1, 2, 3 and 9	No color mark	No length designated
Y	1, 2 and 3	No color mark	No length designated

LIST OF CONNECTICUT BROADLEAF GRADES

Light Wrappers (A Group)

Standard Grade	Description of Grade	Old Grade Mark	
A 1 L	Choice quality	Light wrapper	Pool 1
A 2 L	Good quality	Light wrapper	Pool 2
A 3 L	Fair quality	Light wrapper	Pool 3
A 4 L	Common quality	Light wrapper	Pool 4

Medium Wrappers (A Group)

A 1 C	Choice quality	Medium wrapper	Pool 1
A 2 C	Good quality	Medium wrapper	Pool 2
A 3 C	Fair quality	Medium wrapper	Pool 3
A 4 C	Common quality	Medium wrapper	Pool 4

Dark Wrappers (A Group)

A 1 D	Choice quality	Dark wrapper	Pool 1
A 2 D	Good quality	Dark wrapper	Pool 2
A 3 D	Fair quality	Dark wrapper	Pool 3
A 4 D	Common quality	Dark wrapper	Pool 4

Long Seconds (B Group)

B 1 L	Good quality light colored	Long sections	Pool 1
B 2 L	Fair quality light colored	Long sections	Pool 2
B 3 L	Common quality light colored	Long sections	Pool 3

Short Seconds (B Group)

B 1 L 44	Good quality light colored—16″ to 20″	Short sections	Pool 1
B 2 L 44	Fair quality light colored—16″ to 20″	Short sections	Pool 2
B 3 L 44	Common quality light colored—16″ to 20″	Short sections	Pool 3

Short Seconds (B Group)

B 1 L 43	Good quality light colored binder—12″ to 16″	Short sections	Pool 1
B 2 L 43	Fair quality light colored binder—12″ to 16″	Short sections	Pool 2
B 3 L 43	Common quality light colored binder—12″ to 16″	Short sections	Pool 3

No. 2 Seconds (B Group)

B 1 M	Good quality off colored binder	No. 2 sections	Pool 1
B 2 M	Fair quality off colored binder	No. 2 sections	Pool 2
B 3 M	Common quality off colored binder	No. 3 sections	Pool 3

No. 2 Dark Wrappers (B Group)

B 1 D	Good quality	No. 2 Dark Wrapper	Pool 1
B 2 D	Fair quality	No. 2 Dark Wrapper	Pool 2
B 3 D	Common quality	No. 2 Dark Wrapper	Pool 3

Fillers of Tops (C Group)

C 1 D	Good quality fillers	Tops	Pool 1
C 2 D	Fair quality fillers	Tops	Pool 2
C 3 D	Common quality fillers	Tops	Pool 3

Brokes and Nondescript (X Group)

X 1	Good quality clean	Brokes	Pool 1
X 2	Fair quality clean	Brokes	Pool 2
X 3	Common quality clean	Brokes	Pool 3

Stemmers (Y Group)

Y 1	Good clean ground leaves	Fillers	Pool 1
Y 2	Fairly clean ground leaves	Fillers	Pool 2
Y 3	Common, dirty ground leaves	Fillers	Pool 3

Wet Tobacco (Mixed Group)

B 9	Wet—Pick for Binders (Best Wet)	Wet
C 9	Wet—Pick for Fillers (Medium quality wet)	Wet
X 9	Wet—Low Grade or Stemming and Nondescript (Common)	Wet

REMARKS

Tobacco is graded under the standard system according to quality, color and length. The quality factor is divided into groups of similar quality in order to simplify the grading. Assorting (sometimes called grading) is the act separating tobacco into lots of like quality, color and length. Grading is the act of examining a lot of tobacco (after it has been assorted) and determining into what grade it belongs.

APPENDIX F

METHOD OF CURING VIRGINIA TOBACCO AS PRACTICED IN NORTH CAROLINA, U. S. A.

(1) The fire should be started as soon as the leaves are hung in the barn, raising the temperature inside 5°–10° F higher than the temperature outside, from 85°–100° F (29.4°–37.8° C). Maintain this temperature from 24 to 36 hours until *the leaves are fairly yellow.*

(2) Then raise the temperature 4°–5° F every hour until 120°–125° F (48.9°–51.7° C), depending upon the rapidity with which the green color has faded. *The leaves should be pale yellow* by this time.

(3) Next raise the temperature 4°–6° F each hour until 130°–140° F (54.9°–60° C) which temperature is maintained until *the tissues of the leaves are dry.* During this stage *the yellow color is fixed.*

(4) The moment the leaves are dry, the temperature is raised again from 5°–10° F each hour to 180°–190° F (82.2°–87.8° C). This heat is maintained until *the midribs are also dry throughout the barn.*

In North Carolina it takes from 84–96 hours to cure a barn by this method.

Incidentally during the curing process, the following observations should be taken into account:

(*a*) Weather conditions and texture of the tobacco leaves especially and other factors may require prolonging or shortening anyone of the periods.

(*b*) During the early stages of curing, ample ventilation is needed because of high humidity.

(*c*) During the drying stage all ventilators above and below should be opened.

(*d*) By raising the temperature too fast while the humidity is high, greenish and mottled colors are developed.

(*e*) At 165°–170° F ((73.9°–76.7° C) the humidity should be low and the ventilators closed.

(*f*) It is always necessary to raise the temperature above 140° F (60° C) to make the leaves dry as they should.

ILLUSTRATIONS

PLATE 12

Undulating field of Ilagan Sumatra at the Ilagan Tobacco Station, Ilagan, Isabela.

PLATE 13

General view of a newly shaded wrapper tobacco field. Tubao, La Union.

PLATE 14

A newly shaded tobacco field. Tubao, La Union.

PLATE 15

FIG. 1. A plot of the Bunat tobacco variety fertilized with a complete mixture (1937 Philippine Exposition, Manila).

FIG. 2. The North Carolina Bright Yellow tobacco variety of the Virginia type successfully growing at the Samson Experimental Grounds, 2009 Juan Luna, Manila.

PLATE 16

Shaded tobacco field. This picture was taken after the third priming. Tubao, La Union.

PLATE 17

A typical Batek tobacco plant of the variety Simmaba topped at the right stage to produce a good quality of Batek crop for chewing tobacco.

PLATE 18

One of the few successful introductions, the Samsoun Bafra variety which was imported from Turkey for the production of aromatic cigarette tobacco.

PLATE 19

A typical plant of the North Carolina Bright Yellow variety (of American origin), another successfully introduced tobacco which produces a yellow leaf crop for the manufacture of American-style cigarettes.

PLATE 20

Partial view of a field of White Burley, another American variety successfully introduced into the Philippines.

PLATE 21

FIG. 1. A close-up view of a field of Marogui tobacco at the Ilagan Tobacco Station, Ilagan, Isabela.

FIG. 2. Dusting a field of Florida Sumatra with calcium arsenate to control the ravages of tobacco worms.

PLATE 22

FIG. 1. Typical leaves of the Simmaba variety.

FIG. 2. Typical leaves of the Ilagan Sumatra variety.

PLATE 23

A chart illustrating the effect of crossing two varieties of tobacco.

PLATE 24

A chart illustrating the good effect of continuous selection within a variety in order to isolate and purify the best strain within that variety.

PLATE 25

A chart showing the essentials of aromatic cigarette filler tobacco production in the Philippines.

PLATE 26

A chart showing the essentials of cigar wrapper tobacco production in the Philippines.

PLATE 27

Chart showing the essentials of cigar filler leaf tobacco production in the Philippines.

PLATE 28

Chart showing the essentials of Batek leaf tobacco production in the Philippines.

PLATE 29

A "palillo" or stick of cigar filler tobacco poled in the common manner as generally practiced in the Cagayan Valley. It is now ready to be placed on the racks to undergo the wilting process in the open before it is taken inside the barn for complete curing.

PLATE 30

Curing Sumatra leaf tobacco, Hacienda Caylaway, Nasugbu, Batangas. (Photo by Photo Finishing Corp.)

PLATE 31

A huge curing shed for cigar wrapper tobacco which can accommodate the crop from a 25-hectare plantation. Hacienda Caylaway, Nasugbu, Batangas. (Photo by Photo Finishing Corp.)

PLATE 32

The wrapper tobacco warehouse at Hacienda Caylaway, Nasugbu, Batangas, where the fermentation, classification and baling processes are effected before the crop is transported to Manila.

PLATE 33

A small tobacco baling press devised by the Tobacco Research Section, Bureau of Plant Industry, very handy and appropriate in pressing and packing a 50-kilo bale.

PLATE 34

Baling leaf tobacco at Alhambra Cigar and Cigarette Manufacturing Company. (Photo by Photo Finishing Corp.)

PLATE 35

A standard leaf tobacco bale for export (left) and another for the domestic trade (right) weighing 100 and 115 kilos, respectively.

PLATE 36

Cardboard case of imported American shade grown (top) and wooden case of Sumatra open grown cigar wrapper leaf tobacco.

PLATE 37

Bunches or hands of different types of tobacco raised in the Philippines.

PLATE 38

Different standard sizes of hands of cigar filler leaf tobacco.

PLATE 39

Bulking for fermentation. Tabacalera. (Photo by Photo Finishing Corp.)

PLATE 40

A classification table for leaf tobacco.

PLATE 41

Stripping binder and filler tobacco. Alhambra Cigar and Cigarette Manufacturing Company. (Photo by Photo Finishing Corp.)

PLATE 42

Rolling cigars at Helena Cigar Company. (Photo by Photo Finishing Corp.)

PLATE 43

Cutting cigars into their standard lengths at Helena Cigar Company. (Photo by Photo Finishing Corp.)

PLATE 44

Cigars are placed in racks to dry.

PLATE 45

Banding, cellophaning and packing cigars at Helena Cigar Company. (Photo by Photo Finishing Corp.)

PLATE 46

Sterilizing cigars at Helena Cigar Company. (Photo by Photo Finishing Corp.)

PLATE 47

Electric devices (motors) which supply heat to the sterilizing chambers. Alhambra Cigar and Cigarette Manufacturing Company. (Photo by Photo Finishing Corp.)

PLATE 48

Decorating department at La Flor de la Isabela (Tabacalera). (Photo by Photo Finishing Corp.)

PLATE 49

Boxes of cigars ready for distribution to jobbers or for export. (Photographed by the Bureau of Science).

PLATE 50

FIG. 1. Different boxes of cigars and packets and packages of cigarettes from a combined cigar and cigarette factory (La Yebana).

FIG. 2. Different packets and packages of Philippine manufactured cigarettes.

PLATE 51

FIG. 1. Special packets and boxes of Philippine cigars.

FIG. 2. Different types of Philippine cigars, cigarettes and chewing tobacco and packets of Philippine chewing and smoking tobacco.

PLATE 52

La Flor de la Isabeda, owned by "Compañía General de Tabacos de Filipinas" (Tabacalera), the largest cigar factory in the world.

PLATE 53

Alhambra Cigar and Cigarette Manufacturing Company, a cigar and cigarette factory. (Photo by Photo Finishing Corp.)

PLATE 1.

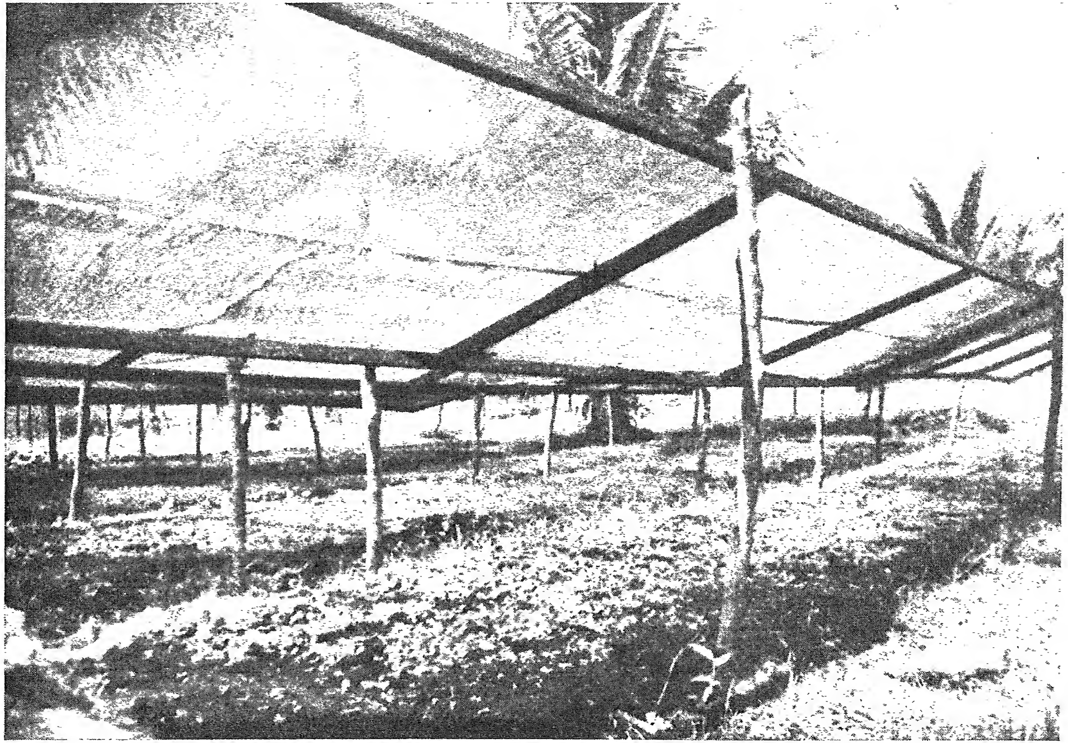


PLATE 2.

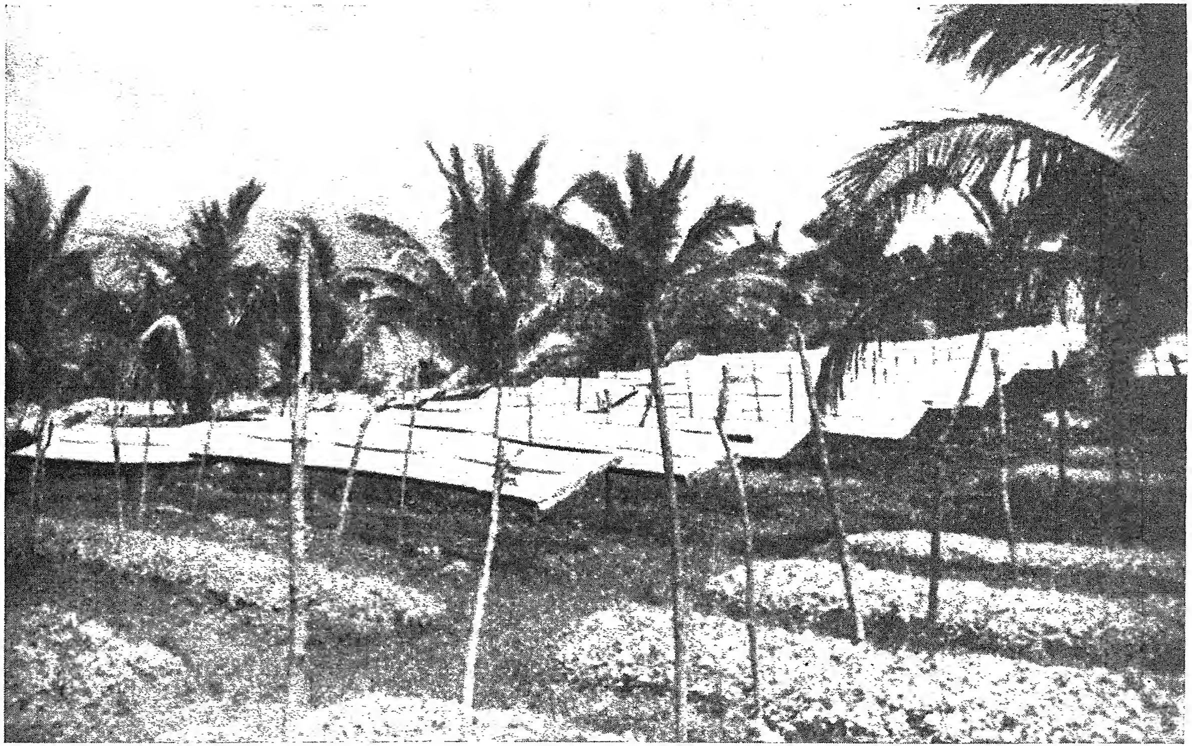
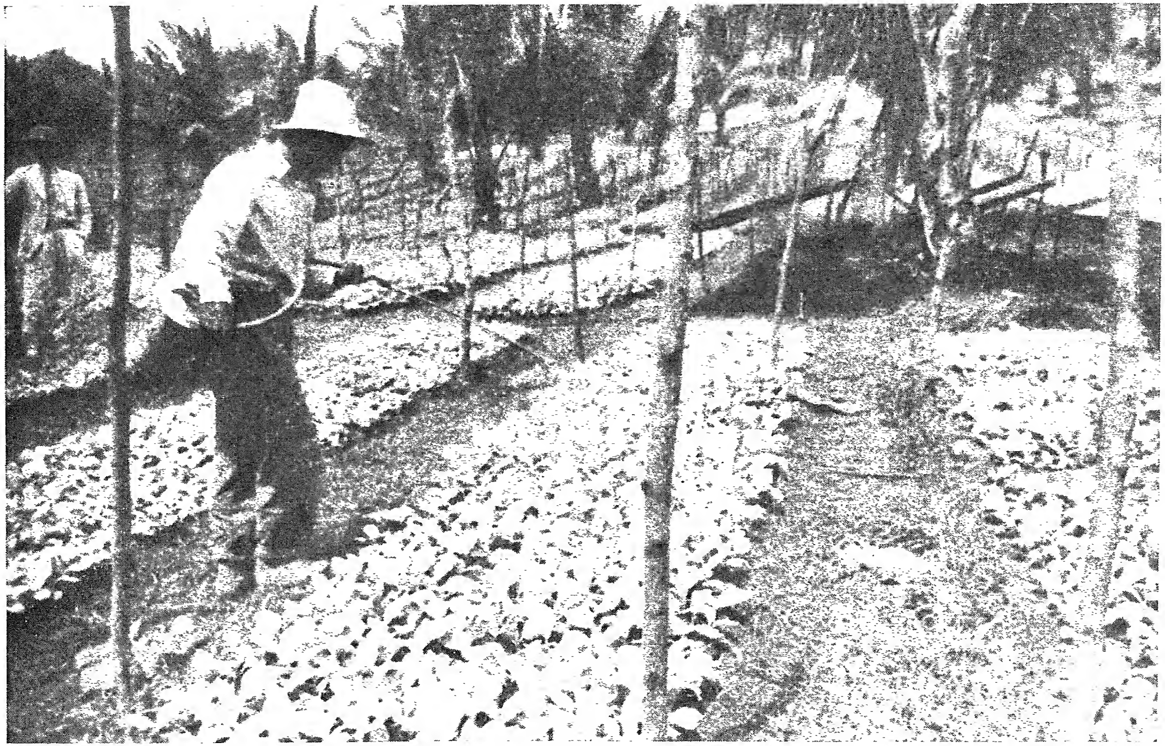


PLATE 3.



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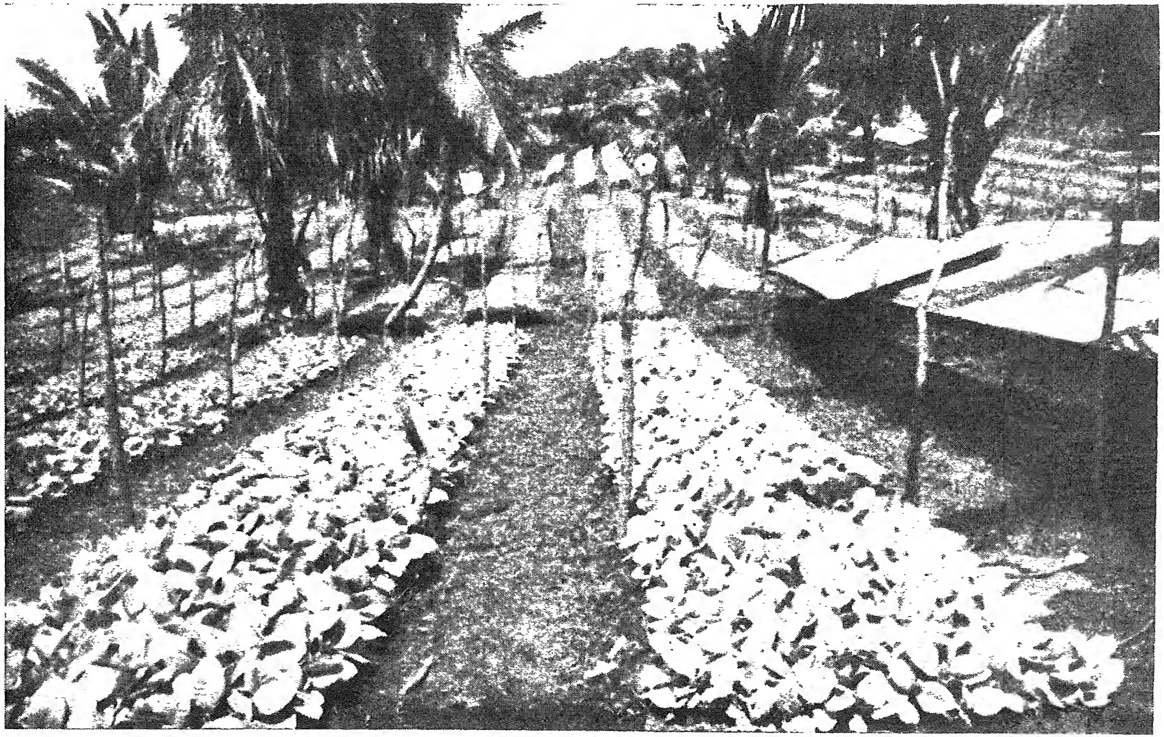


PLATE 5.

PLATE 6.

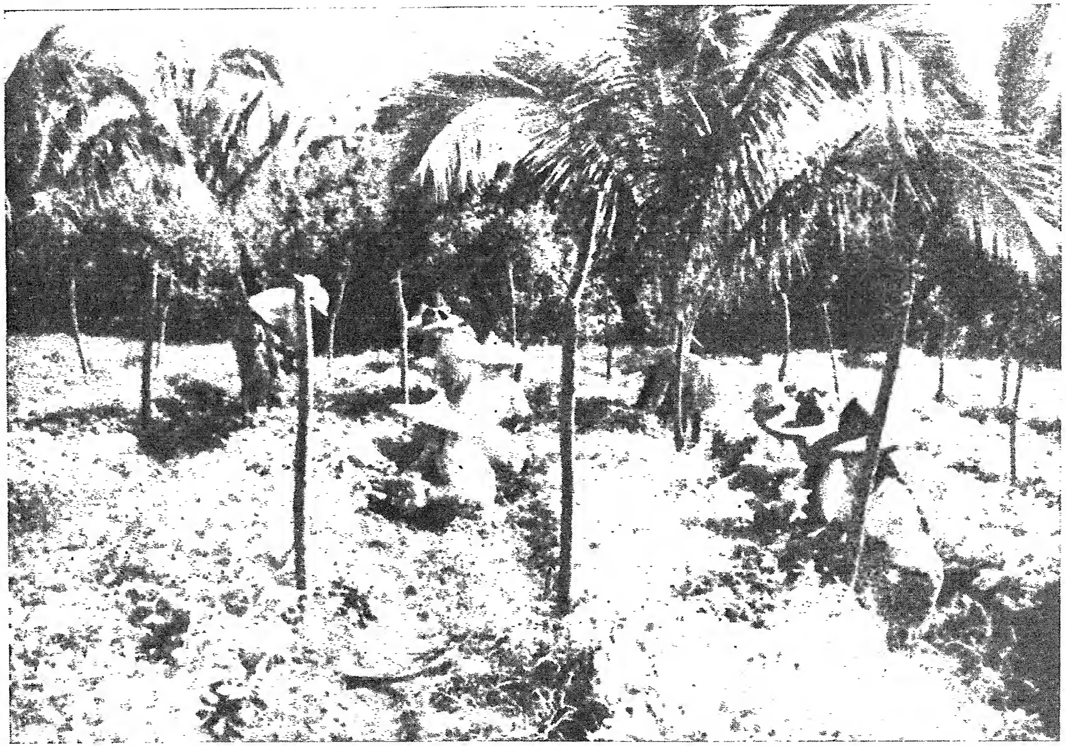


PLATE 7.

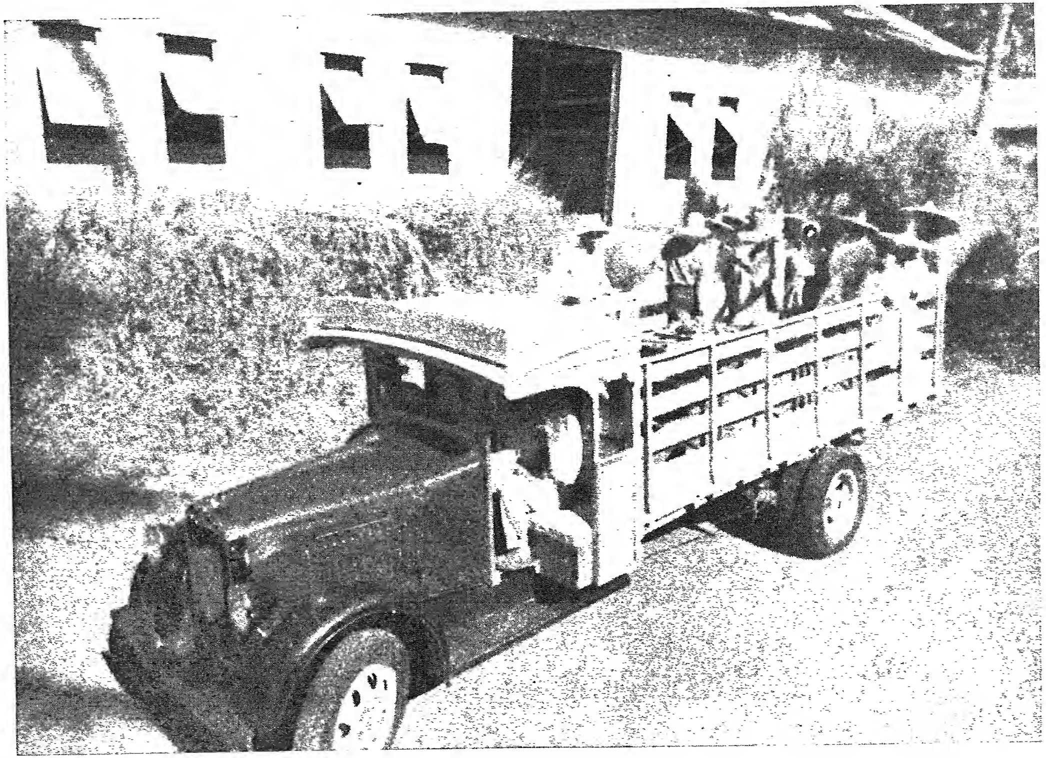


PLATE 8.

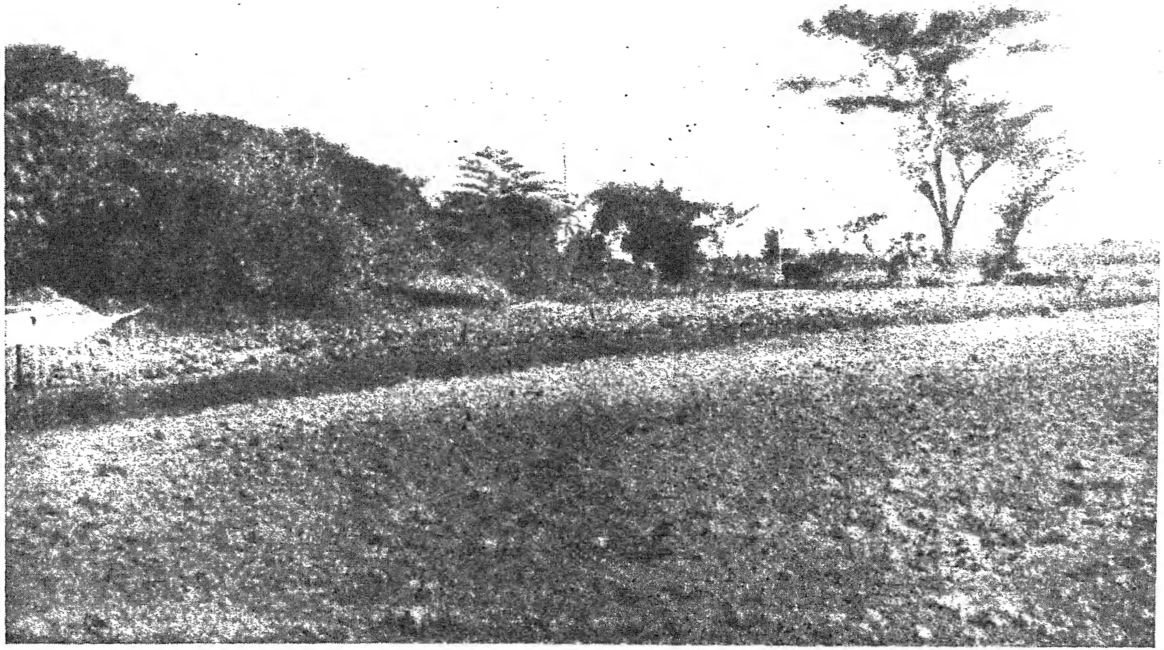


PLATE 9.

PLATE 10.

PLATE 11.

PLATE 12.

PLATE 13.

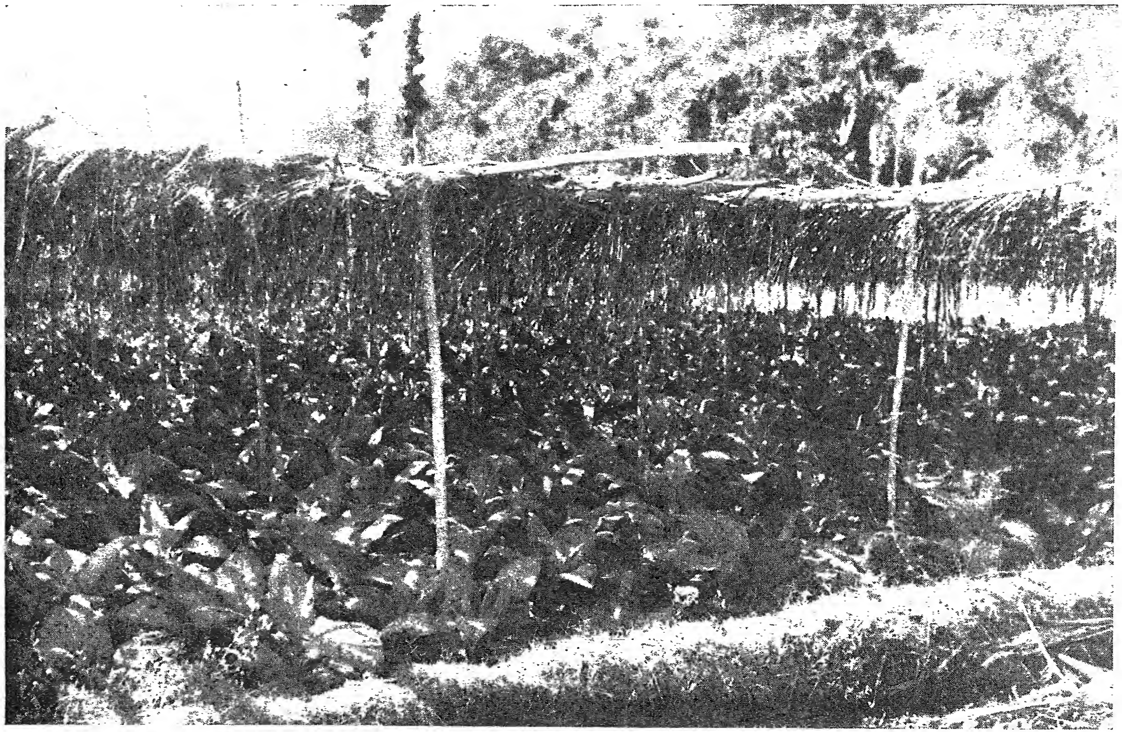
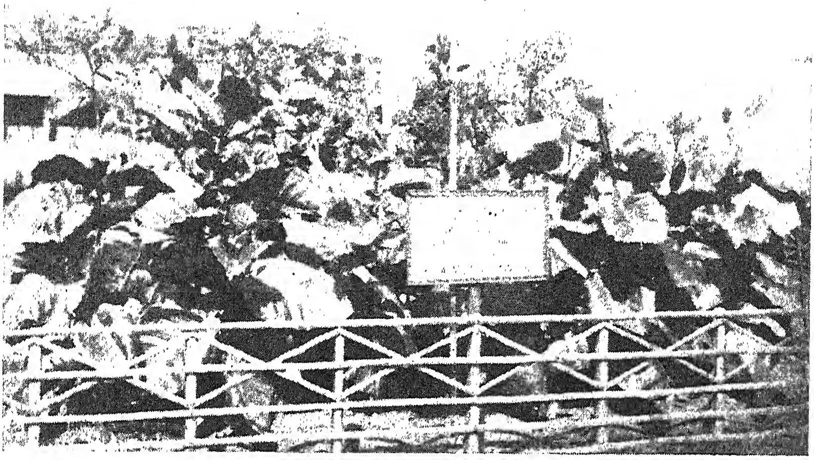


PLATE 14.



1

2

PLATE 15.

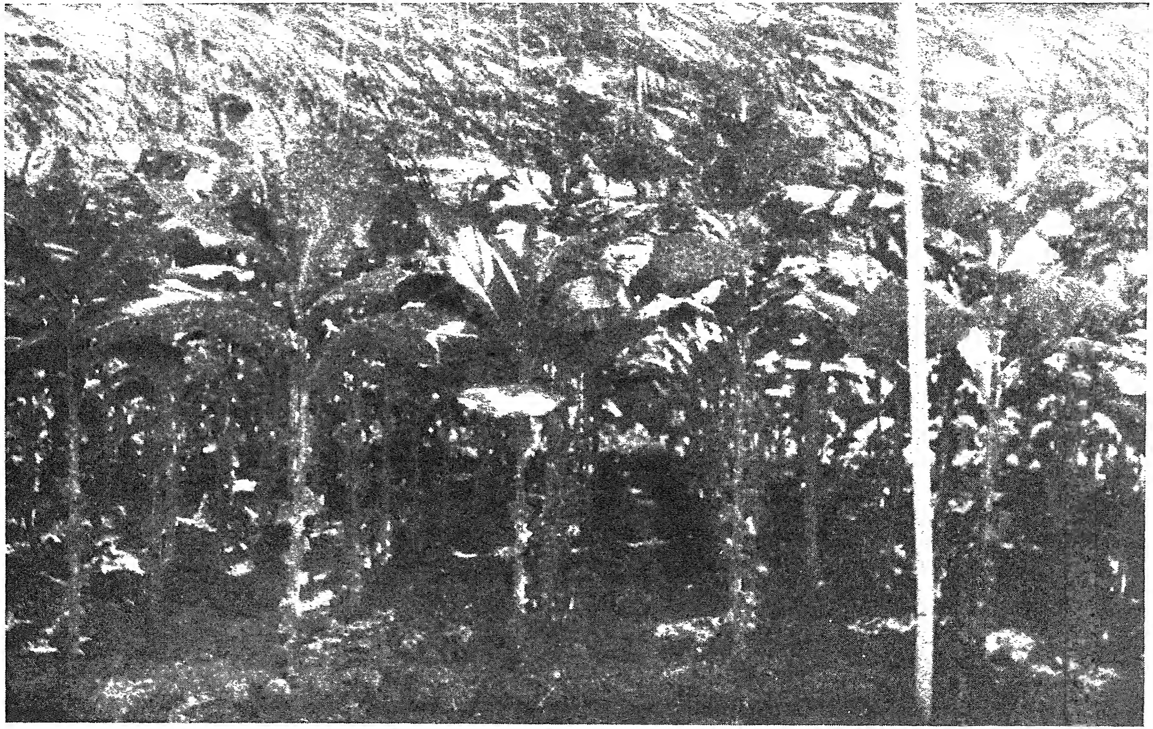


PLATE 16.

PLATE 17.

PLATE 18.

PLATE 19.

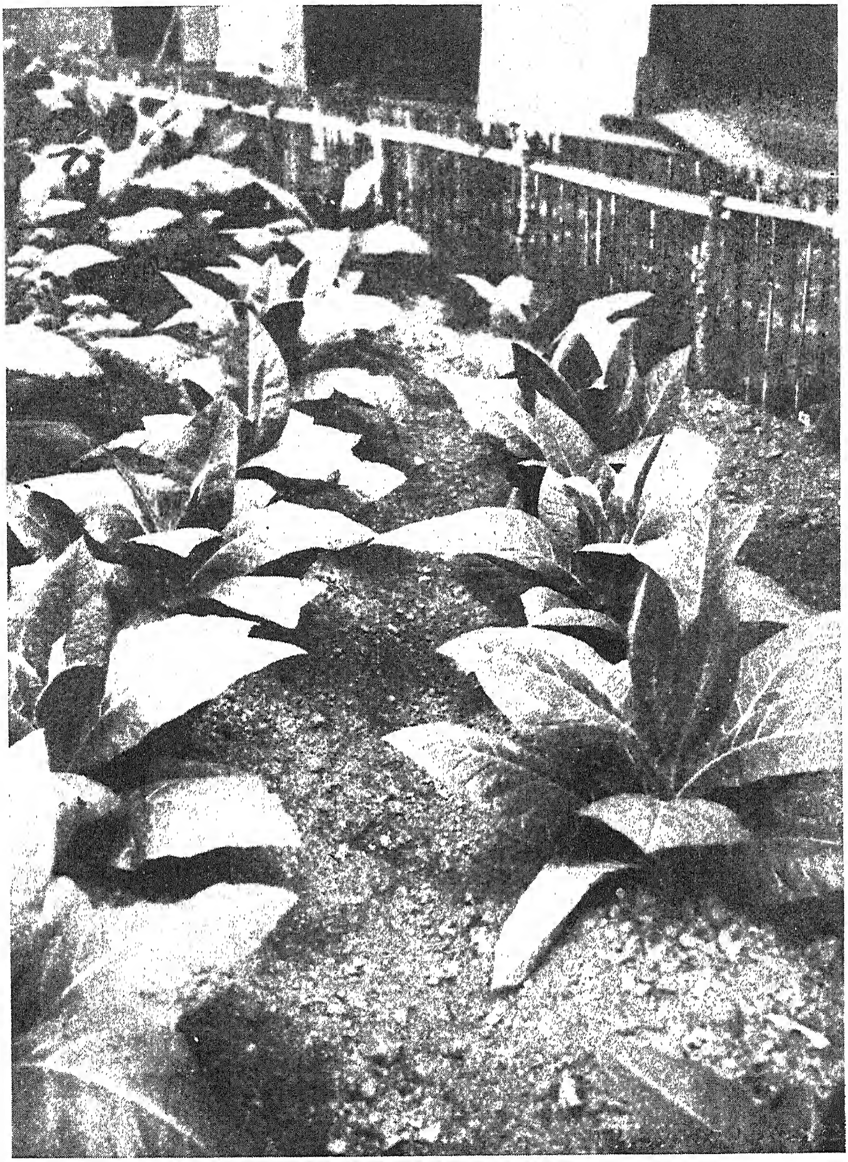
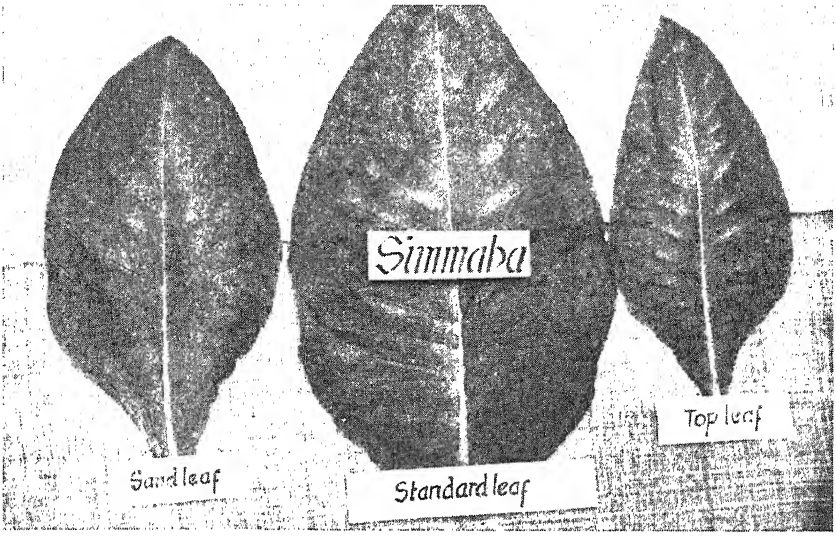


PLATE 20.

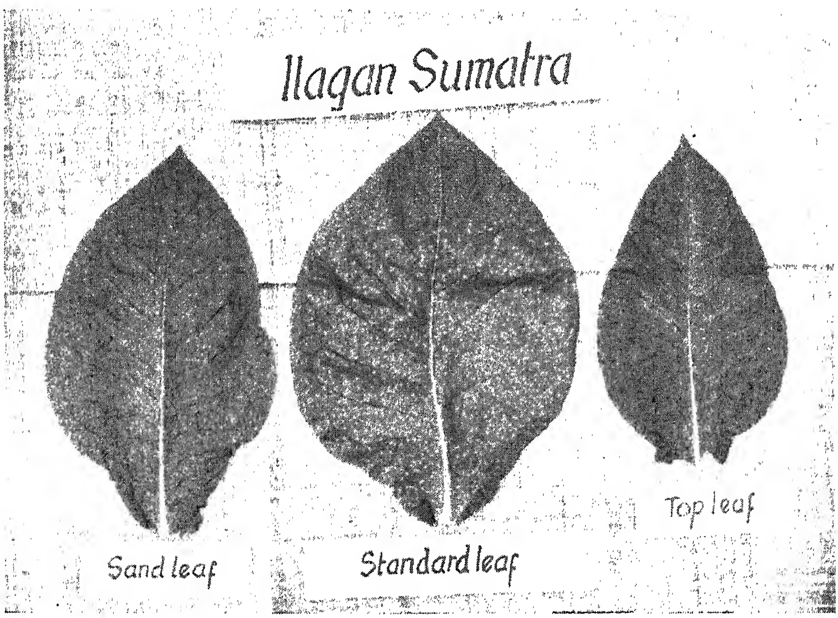
1

2

PLATE 21.


Simmaba
Sand leaf
Standard leaf
Top leaf

1


Ilagan Sumatra
Sand leaf
Standard leaf
Top leaf

2

PLATE 22.

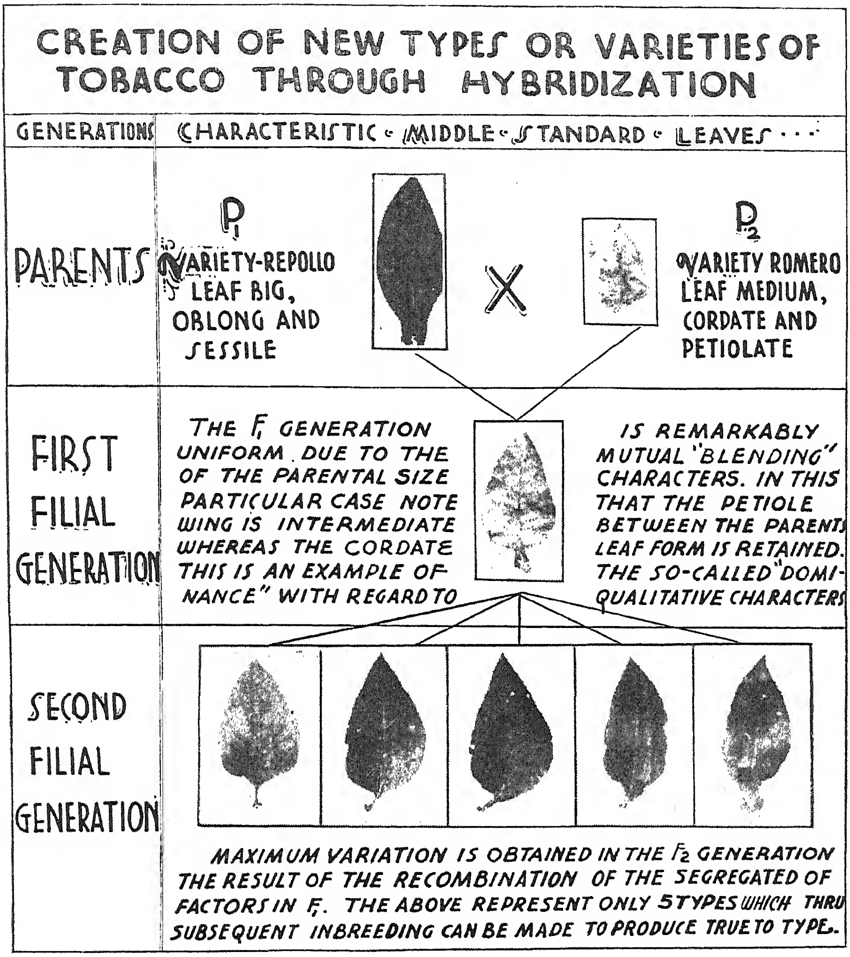
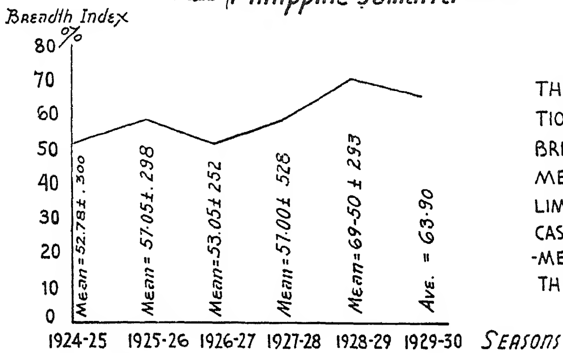

CREATION OF NEW TYPES OR VARIETIES OF TOBACCO THROUGH HYBRIDIZATION
GENERATIONS
CHARACTERISTIC MIDDLE STANDARD LEAVES
PARENTS
P1
VARIETY-REPOLLO LEAF BIG, OBLONG AND SESSILE
X
P2
VARIETY ROMERO LEAF MEDIUM, CORDATE AND PETIOLATE
FIRST FILIAL GENERATION
THE F1 GENERATION
UNIFORM DUE TO THE
OF THE PARENTAL SIZE
PARTICULAR CASE NOTE
WING IS INTERMEDIATE
WHEREAS THE CORDATE
THIS IS AN EXAMPLE OF
NANCE" WITH REGARD TO
IS REMARKABLY
MUTUAL "BLENDING"
CHARACTERS. IN THIS
THAT THE PETIOLE
BETWEEN THE PARENTS
LEAF FORM IS RETAINED.
THE SO-CALLED "DOMI-
QUALITATIVE CHARACTERS
SECOND FILIAL GENERATION
MAXIMUM VARIATION IS OBTAINED IN THE F2 GENERATION
THE RESULT OF THE RECOMBINATION OF THE SEGREGATED OF
FACTORS IN F1. THE ABOVE REPRESENT ONLY 5 TYPES WHICH THRU
SUBSEQUENT INBREEDING CAN BE MADE TO PRODUCE TRUE TO TYPE.

PLATE 23.

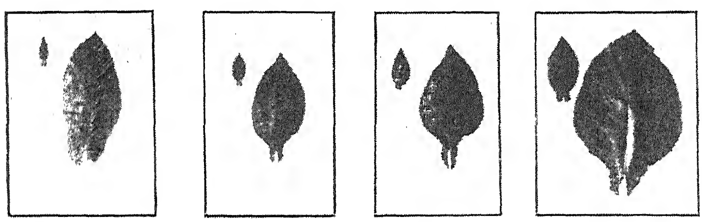
IMPROVING THE TYPE OF A TOBACCO VARIETY BY CONTINUOUS SELECTION

EFFECT OF SELECTION FOR HIGH BREADTH INDEX IN THE VARIETY

~~~ *Philippine Sumatra* ~~~



THIS CURVE SHOWS THAT CONTINIOUS SELECTION AND INBREEDING BRINGS ABOUT IMPROVEMENT UNTIL A CERTAIN LIMIT. IN THE PRESENT CASE MAXIMUM IMPROVEMENT WAS REACHED IN THE 5th GENERATION.



OBLONG (*BREADTH INDEX = 35%*) AND BROADLY ALATE

ELLIPTICAL (*BREADTH INDEX = 53%*) AND MEDIUM ALATE (*Original Type*)

OVATE (*BREADTH INDEX = 58%*) AND MEDIUM ALATE

OVATE-OBRICULAR (*BREADTH INDEX = 69%*) MEDIUM-BROADLY ALATE (*Selected new type*)

MAIN LEAF SHAPE VARIATIONS OF THE VARIETY *PHILIPPINE SUMATRA*

PLATE 24.
~~~

ESSENTIALS OF CIGARETTE TOBACCO PRODUCTION IN THE PHILIPPINES

1. **CHOICE OF VARIETIES.**—The acclimatized American varieties of the Bright group are the best so far. The native Viscaya is recommended for maximum yield although not so aromatic.

2. **SOIL REQUIREMENTS.**— Cigarette tobacco has been successfully produced in soils varying from clay loam to sandy loam of normal fertility.

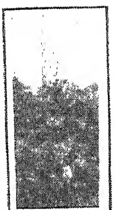


Fig. 1.—A typical plant of the adock variety. (Virginia Type)

3. **CLIMATIC REQUIREMENTS.**—The best quality has been produced in regions with well defined dry and wet seasons. In regions with short dry periods the leaves must be cured in flue-curing barns. And harvesting must coincide with a corresponding period of dry weather.

4. **CULTURAL FEATURES.**— Identical with native methods except that the planting distances are closer, topping is high and in poling, the leaves are spaced to insure uniform curing.

5. **CURING.**—The principle involved is to fix the yellow color when the proper stage is reached. Consequently in the Sun-Curing Method, the poles must be placed in the sun when the leaves have become yellow in the curing shed. In the Flue-Curing Method, the leaves are cured entirely in the barn but the temperature is gradually raised to at least 66°C

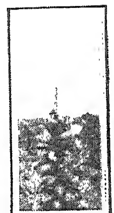


Fig. 2. A Typical Turkish Tobacco Plant.

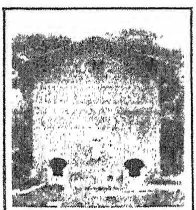


Fig. 3. End Elevation

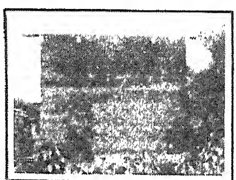


Fig. 4. Side Elevation

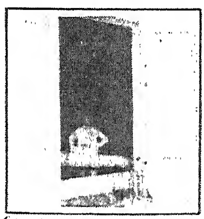


Fig. 5. Showing Arrangement of Flues and Curing Racks and Poles.

VIEWS OF CIGARETTE FLUE-CURING BARN

Material of Flue-Curing Barn - 1st group timber (Ipil); roof and walls - 3rd or 4th group, basal 1/3 of end wall with furnaces (including furnaces) should be of concrete. Flues - G. I., roof surface rendered rain proof with a coating of certen-teed; and walls rendered airtight with tar.

PLATE 25.

ESSENTIALS OF WRAPPER TOBACCO PRODUCTION IN THE PHILIPPINES

1. CHOICE OF VARIETIES – For open cultures Philippine Baker Sumatra, Ilagan Sumatra and Bx For shade cultures Viscaya and Simmaba

2. SOIL REQUIREMENTS – Light sandy loam to silty loam soils

3. CLIMATIC REQUIREMENTS.– Open cultures in regions with a short dry period and with even distribution of rainfall Shade cultures in regions with long dry season and also with short dry periods

4. CULTURAL PRACTICES.– For open cultures the plants are set out 45 – 50 cm. and 80 – 90 cm. apart and cultivation is intensive to insure fast and uninterrupted grouth of the plants. For shade cultures the plants are uniformly set out 70 cm. apart in rows 80 cm. apart

Fig 1. Typical plant of Ilagan Sumatra Tobacco Variety

Fig. 2. Typical plant of Viscaya Tobacco Variety

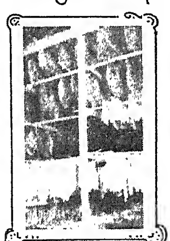
5. CURING.– In both cultures the leaves are strung face-to-face and back-to-back, about 2 cm. apart The leaves are cured or dried entirely in special and spacious curing sheds wherein the temperature is under control so that the slow and natural drying of the leaves can be insured.

Fig. 3. Showing Sumatra method of Planting

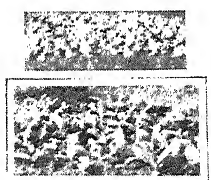
Fig. 4. Cheescloth tent for the production of wrapper tobacco under shade

6. FERMENTATION – The fine texture of the leaves render them able to stand as high as 56–58°C The maximum quantity of leaves in the fermenting pile should be about 12,000 kilos The consequent great pressure developed insure further the glossiness of the leaves

Fig. 5. A model tobacco curing shed for wrapper tobacco



Showing arrangement of curing Racks and Poles.



Seedlings ready for transplanting

PLATE 26.

ESSENTIALS OF CIGAR FILLER LEAF TOBACCO PRODUCTION IN THE PHILIPPINES

Fig 1- A typical plant of the Viscaya, a standard cigar filler variety extensively grown in the Cagayan Valley Other important varieties are the Repollo, Simmaba, Pampano, Marogui and Espada

1. CHOICE OF VARIETIES - The varieties Marogui, Vizcaya, Simmaba, Espada and Pampano are the most suitable for cigar filler leaf tobacco production

2. SOIL REQUIREMENTS - Rich alluvial soils along river banks which are inundated regularly are the best for this type of tobacco

3. CLIMATIC REQUIREMENTS - Regions with short dry periods like the Cagayan Valley are the best adapted for cigar filler leaf tobacco production

4. FIELD CULTURE - The plants are set out in the field 70 by 80cms. apart Cultivation with plow is done at least twice, the first. when the plants are about a foot high, the second, after the sand leaves are harvested. Plants are topped when flower heads are fully developed

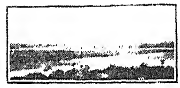


Fig 2- A view of the Cagayan Valley-looking toward Isabela Province from Tuguegarao, the capital of Cagayan Province-showing the great Cagayan River and the lower reaches of the valley. These are the famous sandy alluvialla which being invariably flooded every year, produce the best cigar filler leaf tobacco in the Philippines

5. POLING AND CURING - The leaves are primed as they mature, poled in palillos of about a meter long A "palillo" should contain from 80 to 100 leaves. The poled leaves are placed upon the racks in the curing barn until completely curec

6. FERMENTATION - The cured leaves are piled into "mandalas" for fermentation when they are neither too soft nor too dry. The mandala is rebuilt after every 20 days so as to have a uniform fermentation. Fermented crop is ultimately bundled into bands classified and baled ready for shipment.

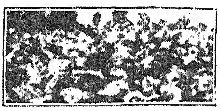


Fig 3- A good stand of cigar filler leaf tobacco but heavily infested with tobacco worms (Note the ravages of the worms on the otherwise sound leaves as a result of the neglect of the grower.) The worms should be put under control by going over the field every morning.

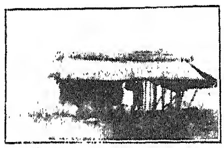


Fig 4- A typical curing shed for cigar filler tobacco in the Cagayan Valley owned by a small grower. This curing shed is just enough to accommodate the harvest from 5,000 plants. To improve the quality of our cigars the farmers should cure their tobacco in better and bigger curing sheds.

Women classifying cigar filler leaf tobacco.

PLATE 27.

ESSENTIALS OF BATEK LEAF TOBACCO PRODUCTION IN THE PHILIPPINES

Fig 1- A typical Batek plant of the Simmaba variety at the early stage of Batek formation To obtain first class quality Batek, only 8 to 10 standard leaves are allowed to develope by topping the plants early

Fig 3-A typical plant of the Romero variety When cultured as Batek, it produces a very excellent crop for the manufacture of chewing (mascada) tobacco

1. CHOICE OF VARIETIES.- Any good cigar filler variety like the Vizcaya and the Simmaba is also good for batek tobacco production.

2. SOIL REQUIREMENTS.—Soils ranging from sandy loam to clay loam which are exceedingly fertile and well-drained are the most suitable for batek culture.

3. CLIMATIC REQUIREMENTS.- Regions with well-defined dry and wet seasons like La Union and Pangasinan are ideal for batek tobacco production.

4. FIELD CULTURE. — The plants are set out in the field 80 centimeters by 1 meter. Cultivation is done in similar manner as the cigar-filler. Topping is performed when the plants have produced eight to twelve leaves by pinching the bud. Suckers are removed as fast as they appear.

5. HARVESTING & CURING.- The leaves are harvested as soon as they develop the characteristic brown spots. A good curing barn for cigar filler tobacco is also good for curing batek tobacco.

6. FERMENTATION.-The leaves are removed from the palillos when they are thoroughly cured, then bundled to form a hand of 100 leaves after which they are ready for storage in big boxes for fermentation and aging processes.

Fig 2- A typical Batek tobacco plantation of the Simmaba variety which is extensively grown in the provinces of La Union and Pangasinan The plants are topped uniformly

Fig 4- A very typical plant of the Simmaba variety topped too late for Batek production. This is only good for cigar-filler leaf tobacco production

PLATE 28.

PLATE 29.

PLATE 30.

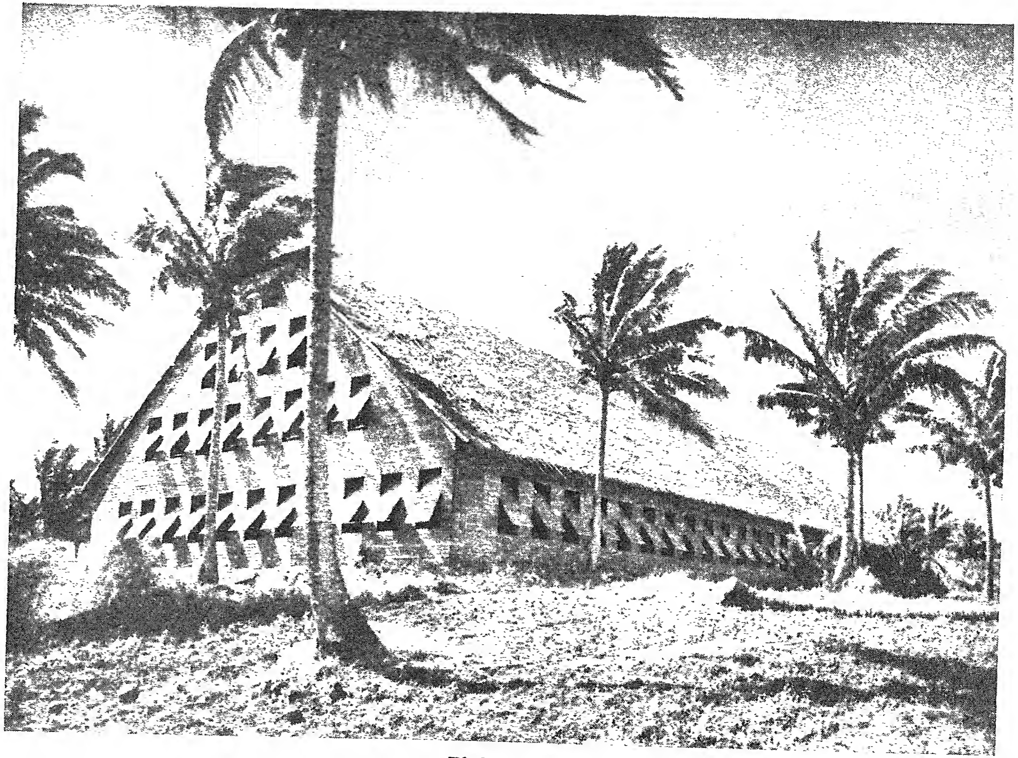
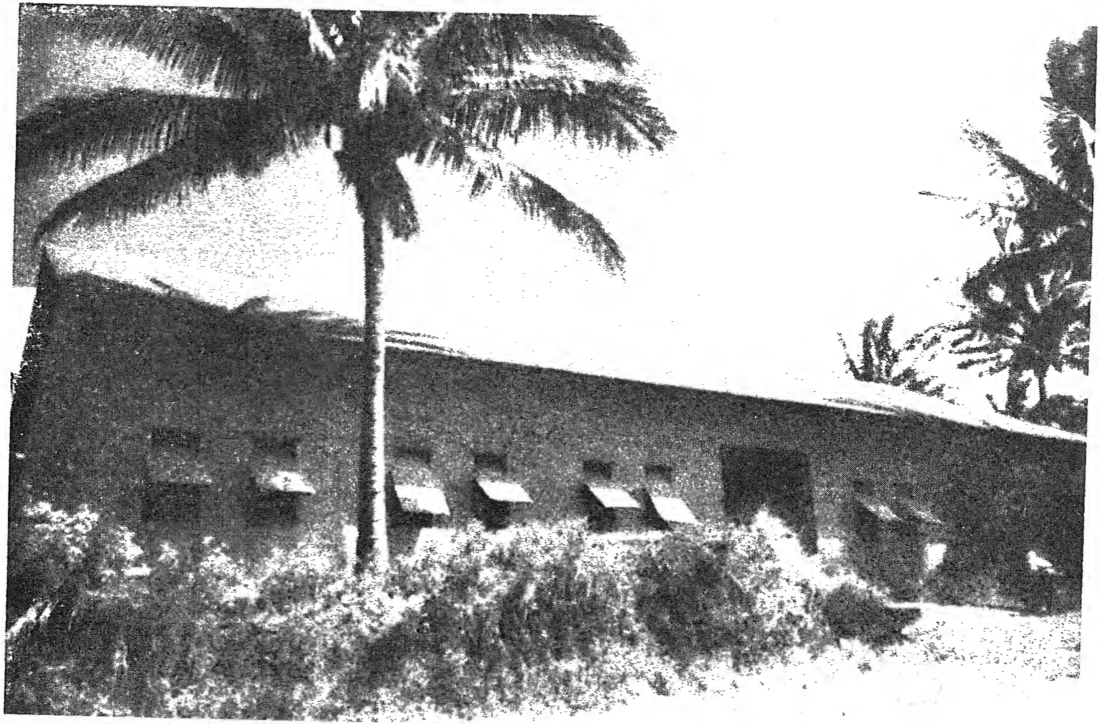


PLATE 31.



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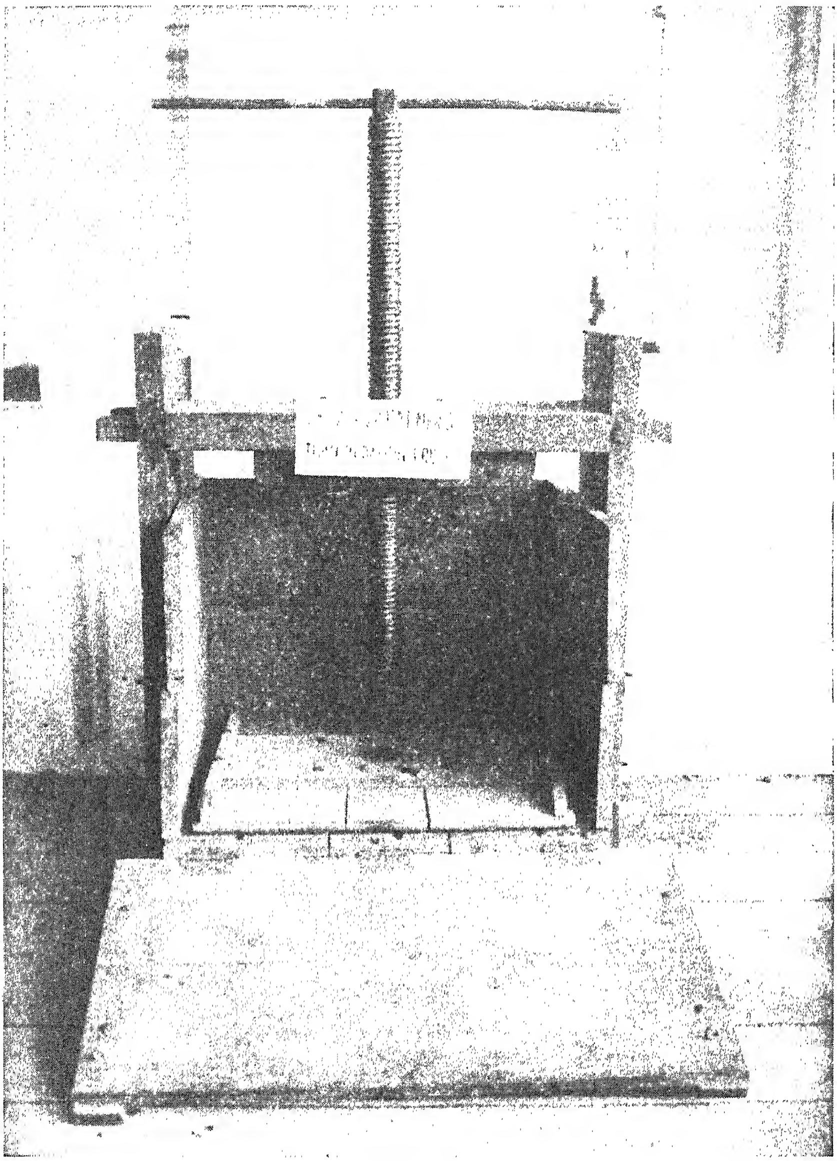

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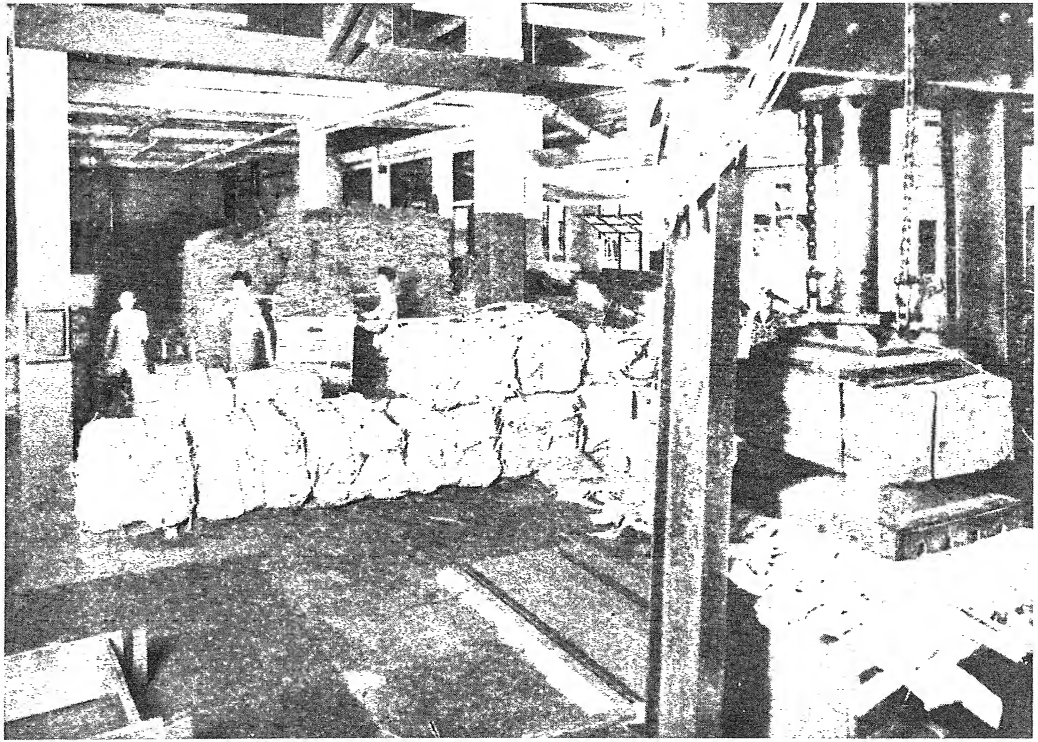

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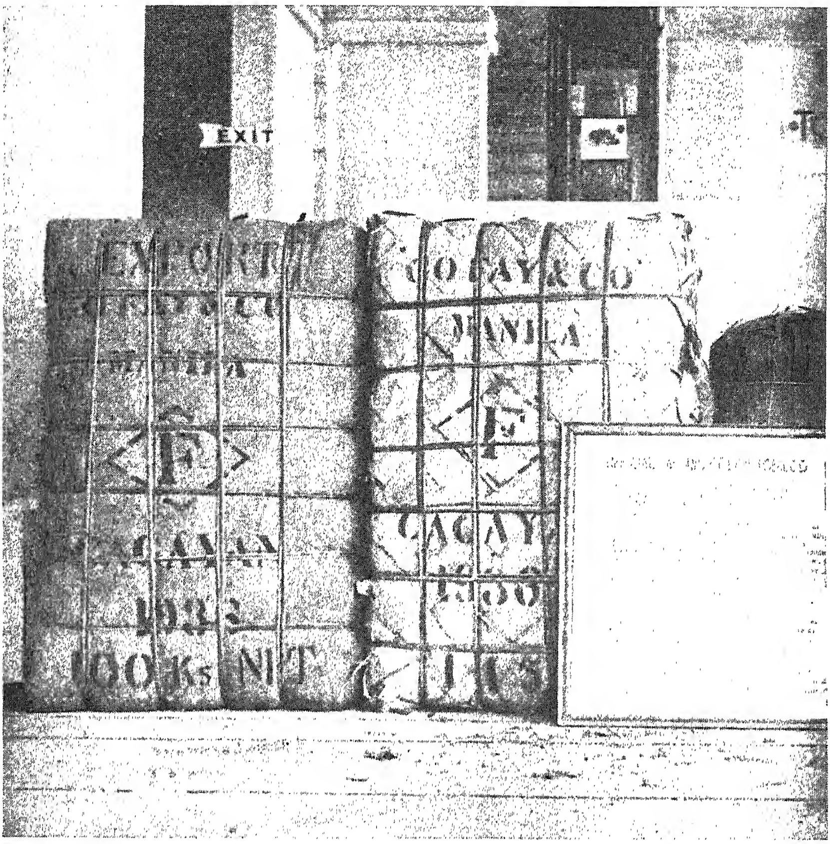

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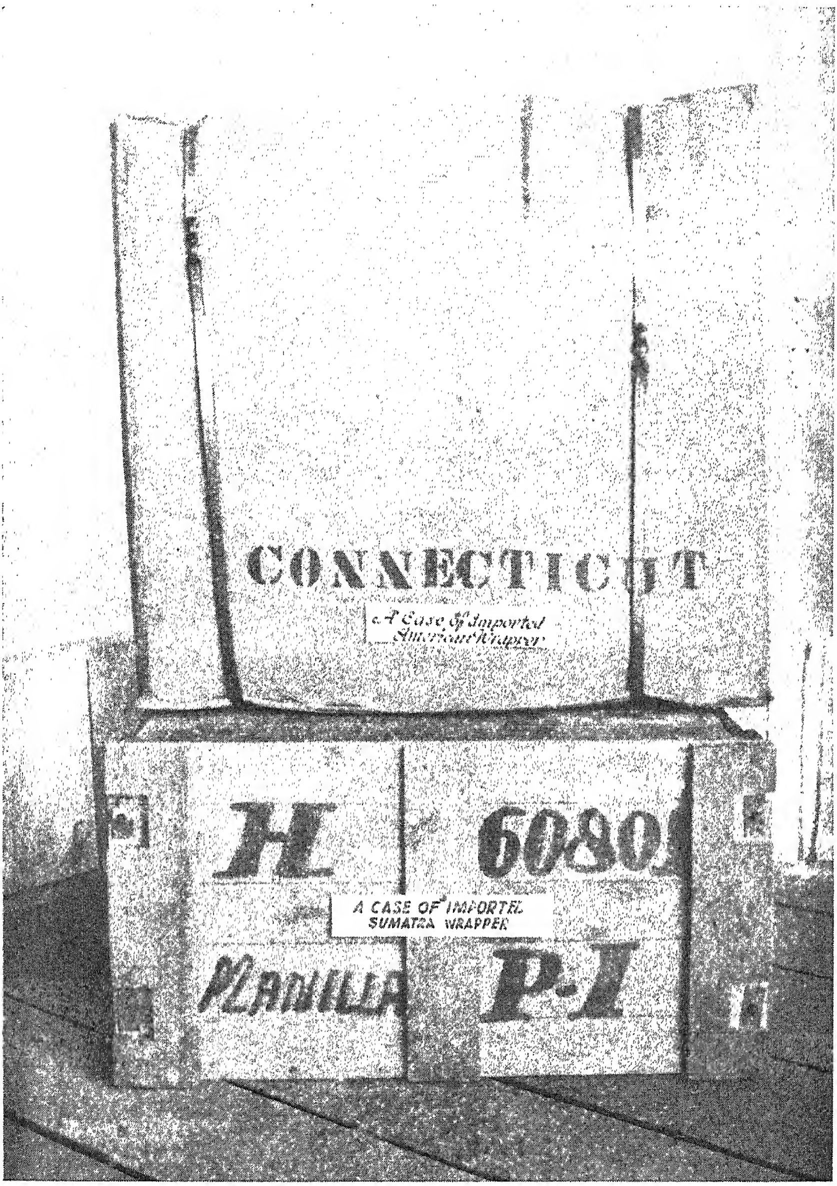
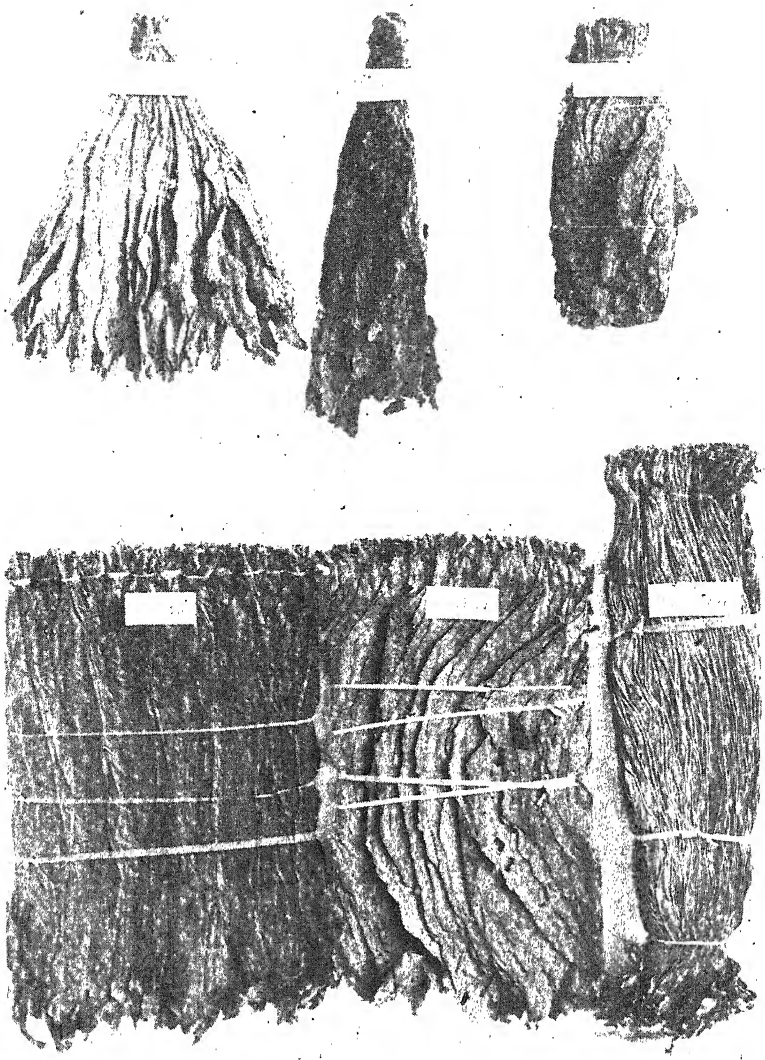

CONNECTICUT
A Case of Imported American Wrapper
H 6080
A CASE OF IMPORTED SUMATRA WRAPPER
MANILA P. I

PLATE 36.



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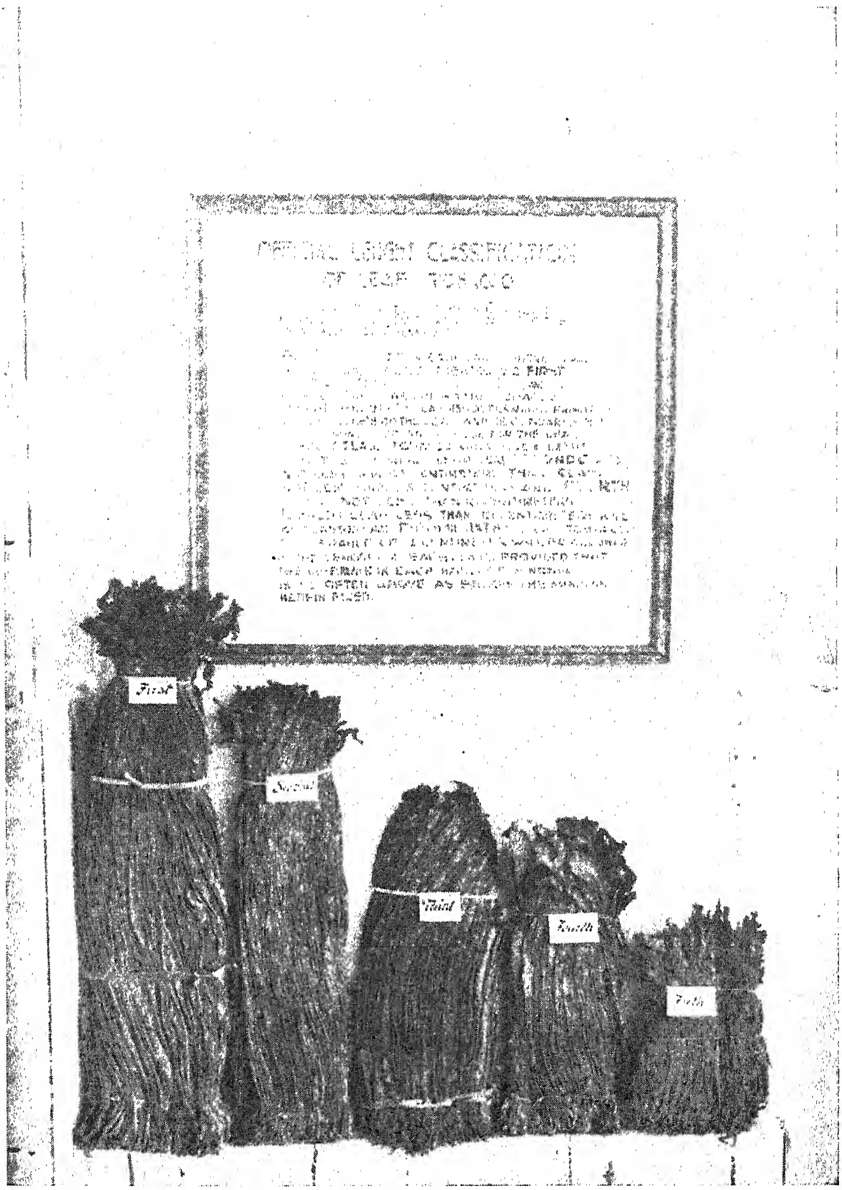

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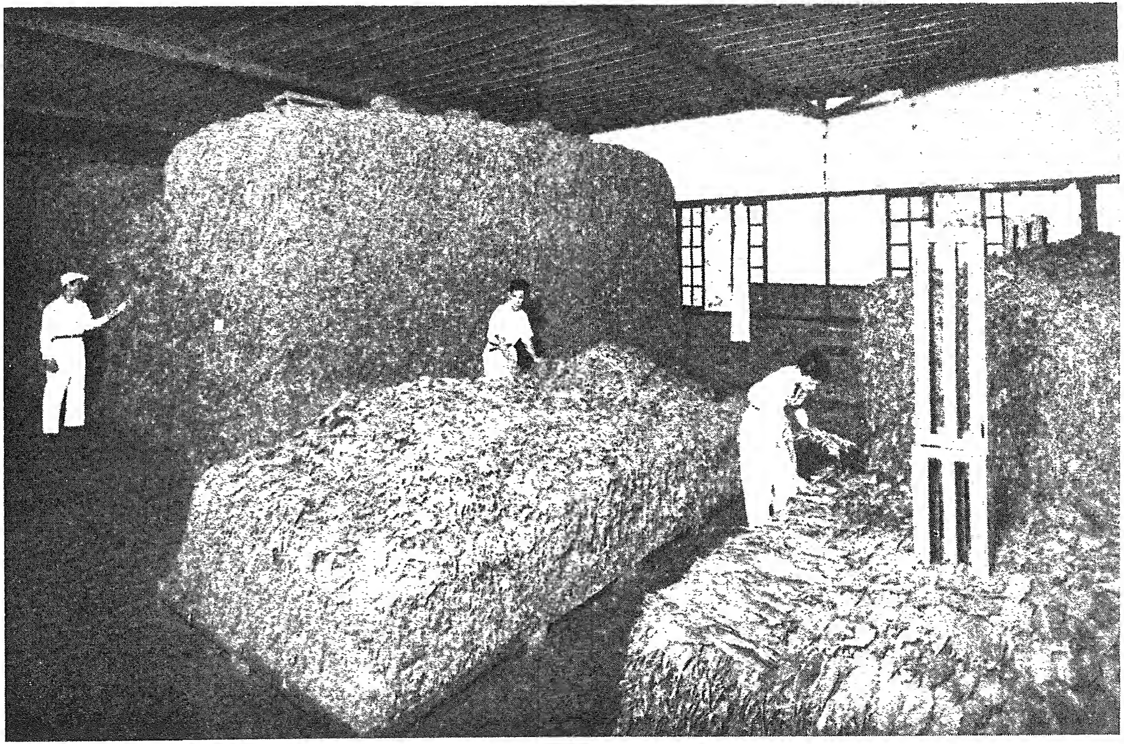

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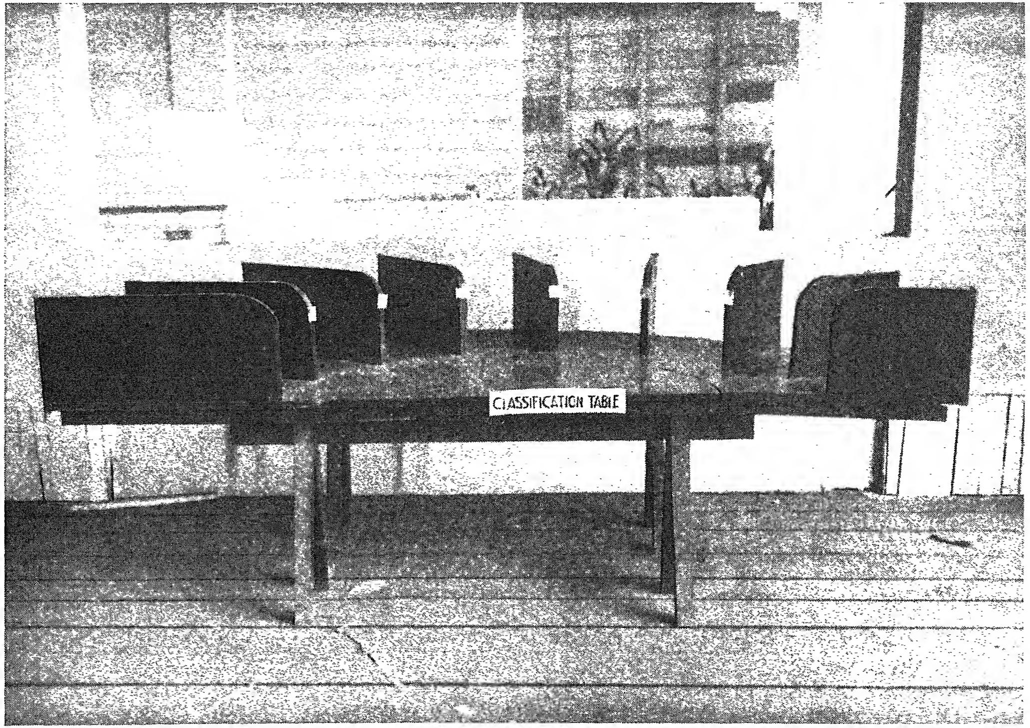

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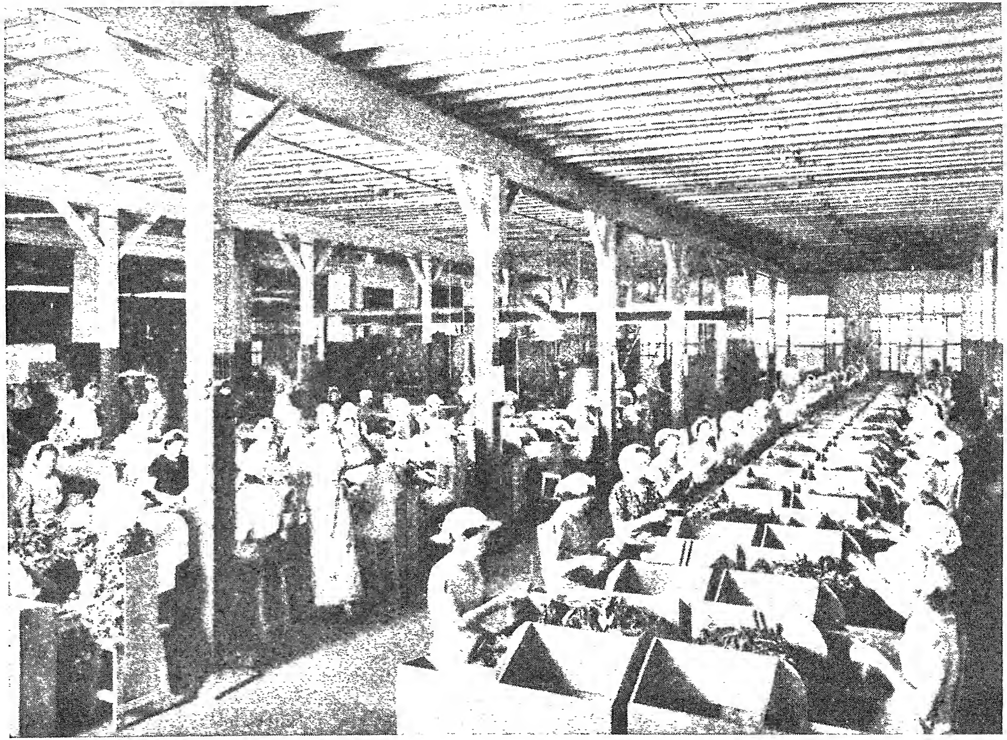
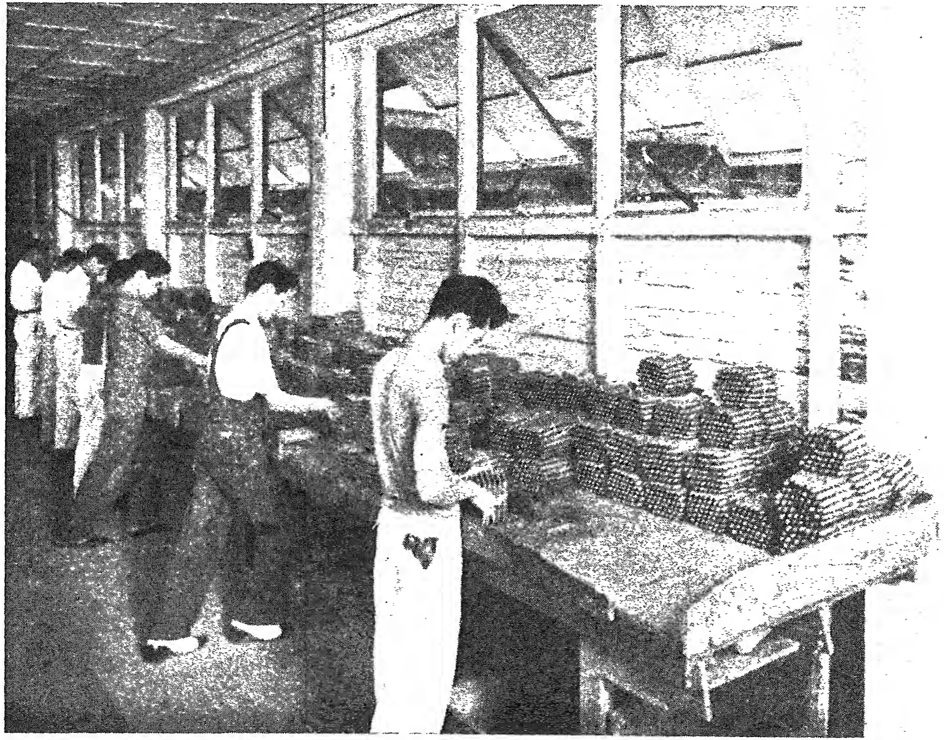


PLATE 41.

PLATE 42.



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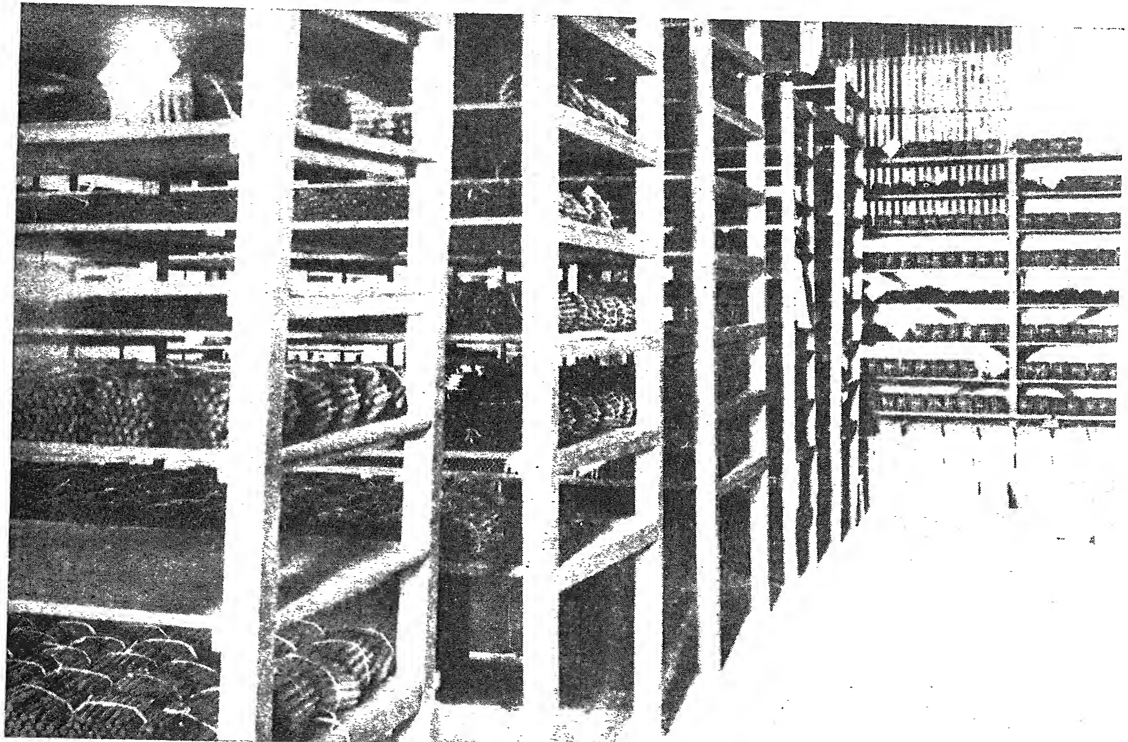
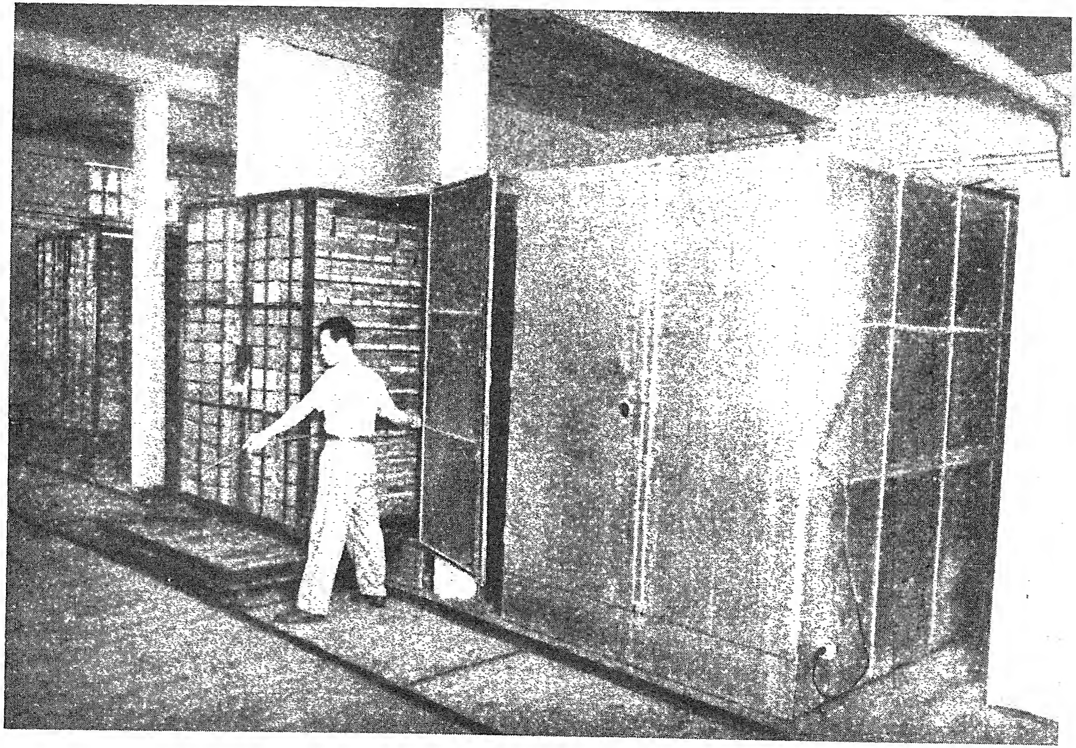


PLATE 44.

PLATE 45.



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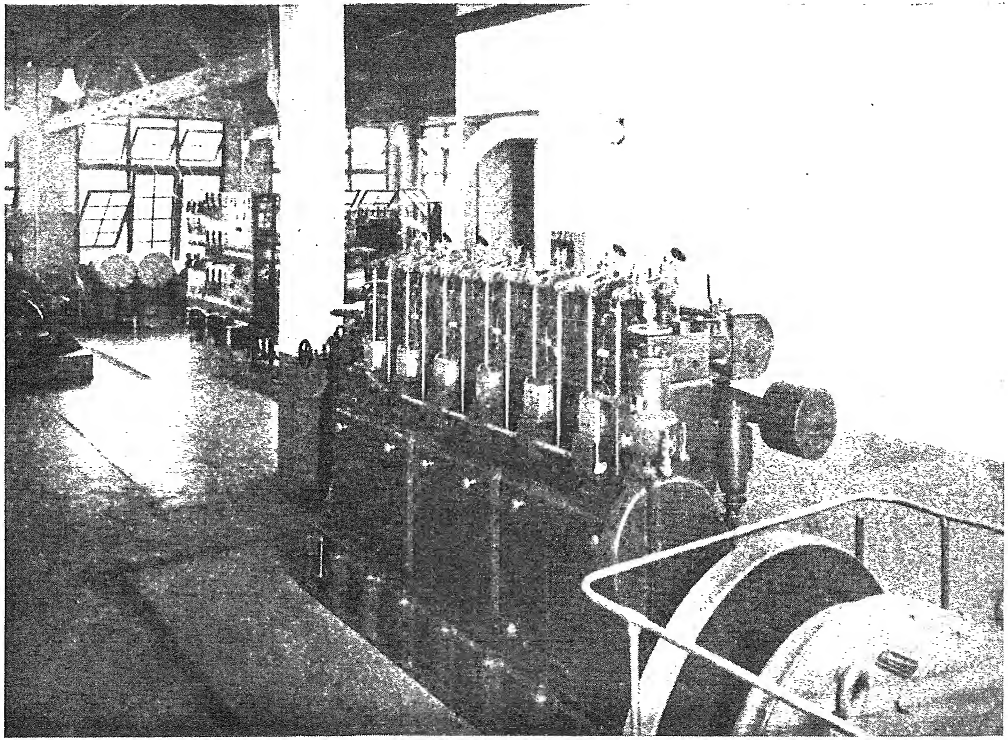

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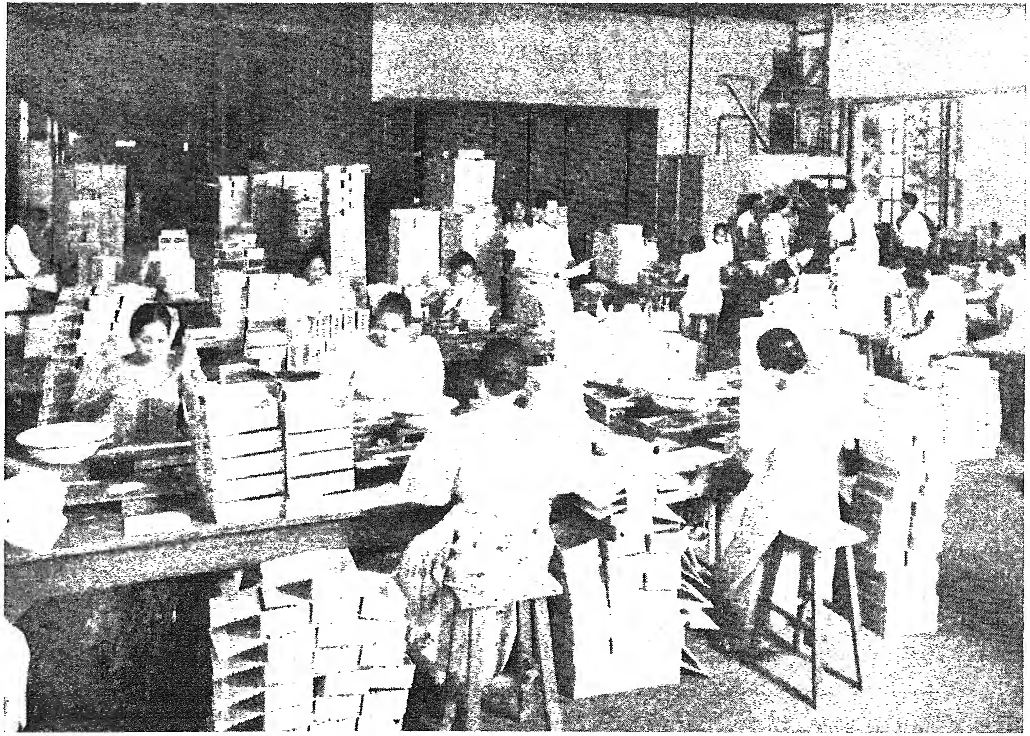

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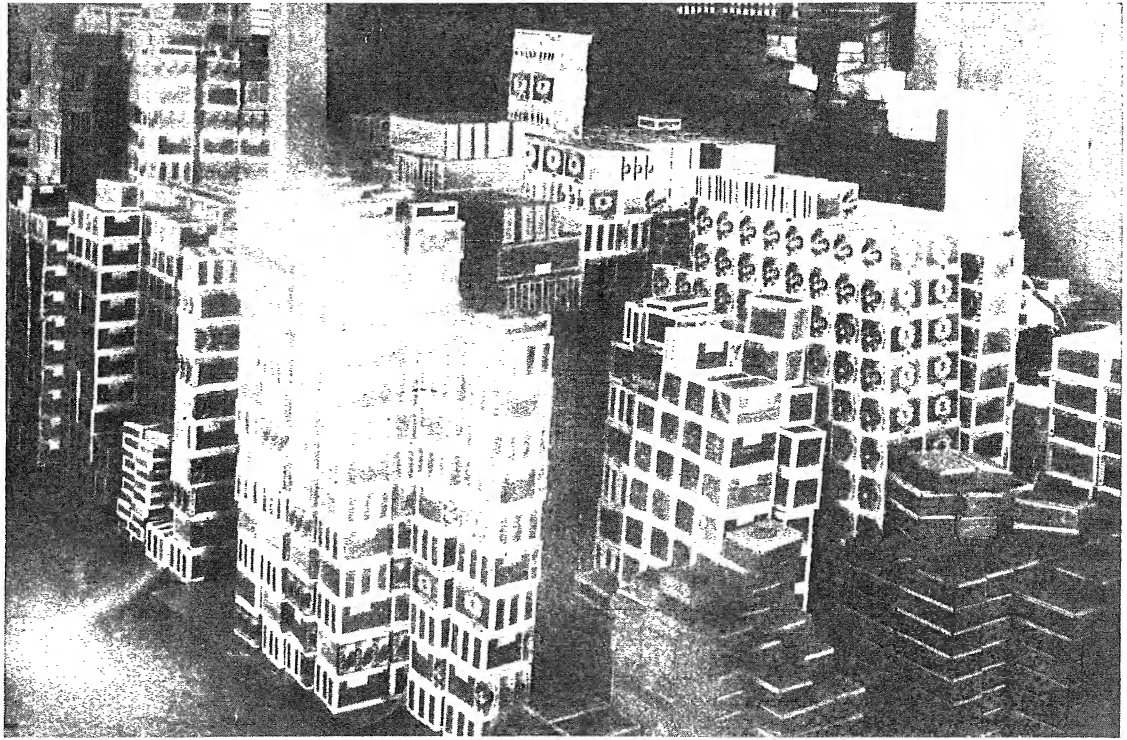

PLATE 49.

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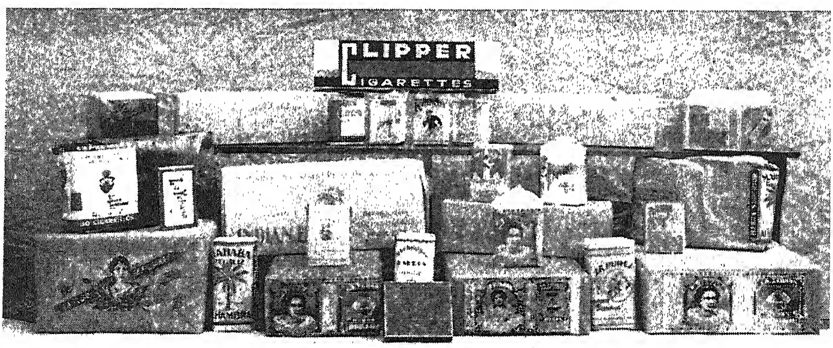

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PLATE 50.

1

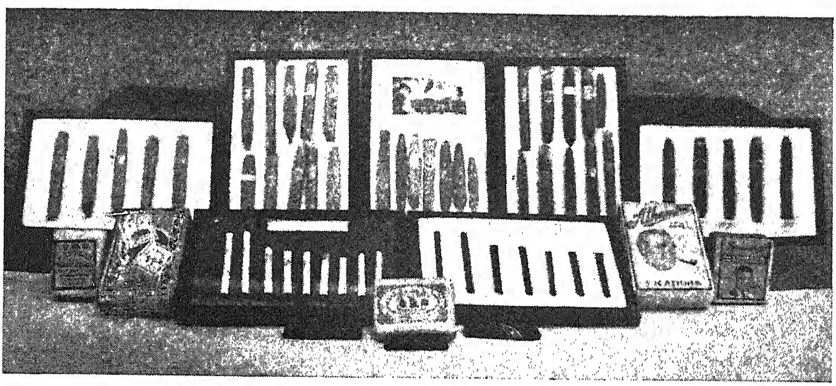

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PLATE 51.

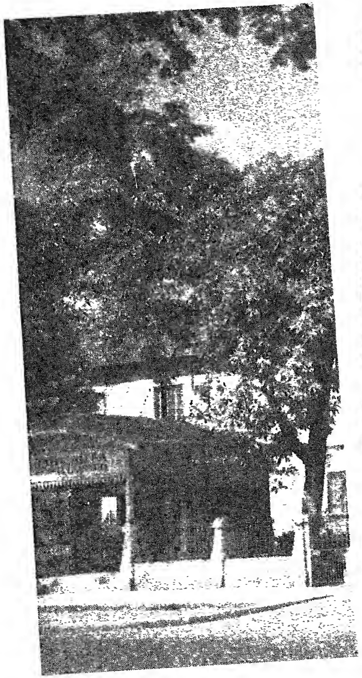

PLATE 52.

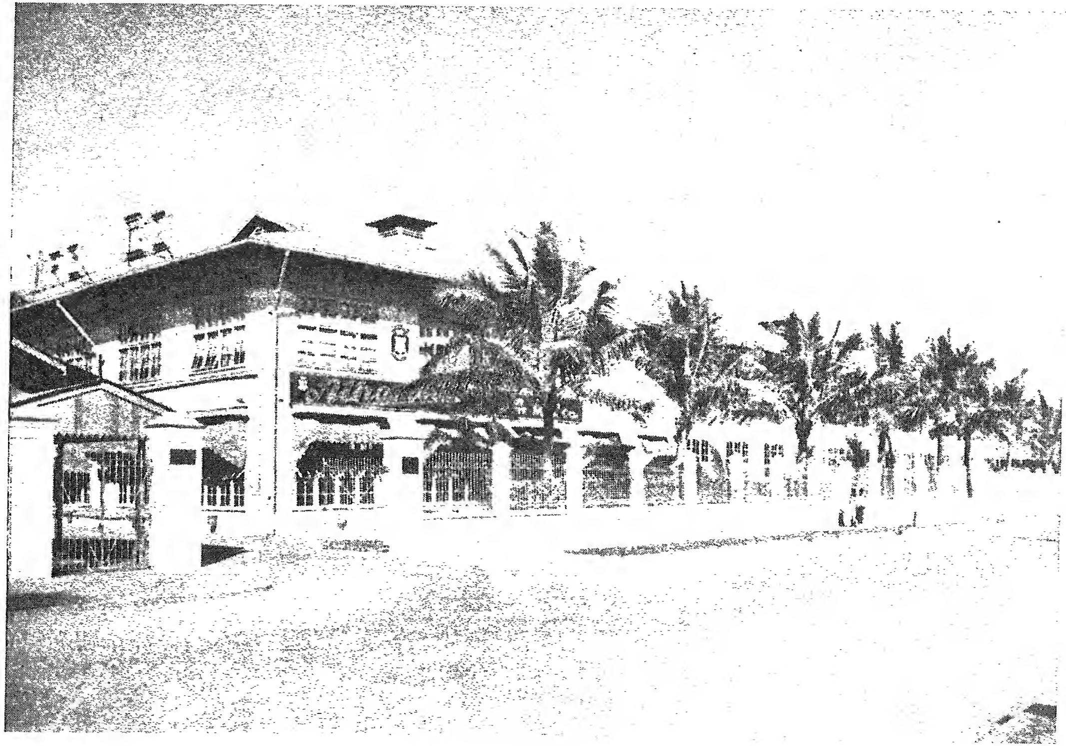

PLATE 53.

STUDIES ON SOYBEAN NODULE BACTERIA (*Rhizobium* sp.): 1

By JULIAN A. AGATI and EUGENIA H. GARCIA
Of the Bureau of Plant Industry

THREE PLATES

Heretofore, practically no studies on the root nodule bacteria of leguminous plants have ever been made in the Philippines. Recently, Aquino and Madamba(1) performed some reciprocal cross inoculations between certain species of legumes, using the organism isolated from the nodules of each plant studied.

Strictly speaking, the problem on the root nodule bacteria of Leguminosae is not new. Since the publication of the classical works of Hellriegel and Wilfarth (1888); Lawes and Gilbert (1889–1891); and Beijerinck (1888) or approximately about the last decade of the nineteenth century, portraying undisputable proofs on the fixation of atmospheric nitrogen as closely related to the presence of bacteria in the nodules on the roots of leguminous plants, the importance of the root nodule bacteria in the nitrogen-nutrition of the higher plants, and the rôle they play in conserving soil fertility have been generally accepted and greatly emphasized by various investigators from different countries of the world. Indeed, literature treating in detail the various phases of the root nodule bacteria has accumulated since then. The excellent monograph by Fred et al.(7) gives a comprehensive review of the important papers dealing with the root nodule bacteria of leguminous plants up to the present time.

The present trend of extensive as well as intensive investigations on root nodule bacteria, however, seem to deal more with the actual causes of and conditions favorable for nitrogen fixation and the effect of inoculation on the yield and quality of legumes. As a result, the recent findings of various investigators tend to show that a certain leguminous plant inoculated with the type or strain of bacteria isolated from its own nodule is generally far superior to the uninoculated ones. The work of Thornton(16) on lucerne inoculation and others (4), (6), etc. on soybeans calls attention to the necessity of using effective strains,

in order to augment and improve the quality of the yield of the crop. Legume inoculation, using specific strains of the nodule bacteria, has now become an established agricultural practice and is being emphasized by various workers, (2), (4), (5), (9), (10), (11), and (16), to mention just a few of the more recent papers.

OBJECTS OF THE EXPERIMENT

When the Bureau of Plant Industry embarked in its program of crop diversification, attention was directed to the introduction and acclimatization of soybeans(14). As is true with any other plant immigrants, the success of growing soybeans depends on a number of factors, namely, the adaptability of the new crop to local conditions such as climate and soil, and to the cultural requirements of the crop. One of the Bureau's first concerns at the outset was to accelerate the distribution and cultivation of soybeans in as many parts of the Islands as possible. In trying to help attain this objective, the writers conducted studies on the organisms from the nodules of soybeans. The results of their investigations consisting of (1) isolation of the organism; (2) testing the cultures for nodule formation; and (3) nitrogen-fixation test are presented in this paper. Other phases of the investigation are in progress.

MATERIALS, METHODS, AND RESULTS

Isolation of the nodule bacteria.—Our studies on soybean bacteria were started about two and a half years ago in our Central Experiment Station, Malate, Manila. Our isolation studies were made mostly with Macoupin variety, then available for our purpose. Healthy plants with a goodly number of nodules were gathered from the soybean fields of the Bureau and taken to the laboratory so as to wash the roots and the nodules thoroughly with tap water. For our purpose only young, tender and sound nodules were selected, cut from the roots, and placed in test tubes containing distilled water for further washing. Then they were disinfected with fresh mercuric bichloride solution (1:1000) for 5 to 10 minutes or more and later rewashed with sterilized distilled water to remove the disinfectant. Finally, to get a bacterial suspension, the nodules were crushed with a flammed scalpel in test tubes, almost one third full of sterile distilled water. Loopfuls of the bacterial suspensions were transferred to petri dishes and covered with cool melted

Ashby's mannitol agar medium consisting of the following ingredients:

Mannitol ($C_6H_8(OH)_6$)	15 gms.
Sodium chloride (NaCl)	0.2 gm.
Monobasic potassium phosphate (KH_2PO_4)	0.2 gm.
Magnesium sulphate $MgSO_4$ 7 H_2O)	0.2 gm.
Calcium sulphate ($CaSO_4$ 2 H_2O)	0.1 gm.
Calcium carbonate ($CaCO_3$)	5.0 gms.
Distilled water	1,000 cc.
Washed agar	20 gms.

Reaction adjusted to pH 7.0[a]/.

Later, following the modified method of Wright(17), (18) the above-mentioned medium was prepared using 10 gms. of mannitol; 1.0 gm. of $CaCO_3$; 0.5 gm. of the phosphate; 900 cc. distilled water; 100 cc. sterile yeast water plus the other above-mentioned chemicals without changing their amounts. The yeast water was prepared from Fleischmann yeast, commonly sold in the market, following the method of Fred et al.(8).

After 7 to 15 days of incubation in the laboratory, the poured plate cultures showed some bacterial colonies. With the aid of a magnifying glass some of the colonies were selected and marked with India ink and by means of a sterile needle, separate transfers of each were made in test tubes containing yeast-water mannitol agar. For purposes of present identification, and pending their proper classification, the individual cultures were marked respectively as isolates 1, 2, 3, 4, 5, 6, and 7(u). Isolate 7(u) originated from a commercial culture obtained from Urbana, Illinois, U. S. A.

The isolates, however were not all obtained at the same time, but at different intervals as the work progressed. In fact, at the start only one was isolated, but a little later two more were added. Subsequently another two were isolated and finally one more was added, thus bringing the number of the isolates to six, excluding the one isolated from a commercial culture obtained from Urbana, Illinois, U. S. A.

Cultural characters.—The above-mentioned seven isolates were grown in different media not only to have their individual cultural characteristics studied but also to find out the medium most suitable for maximum growth. In our nodulation studies,

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[a] The phosphate was dissolved separately and made neutral to phenolphthalein before the rest of the ingredients were added.

it was important to obtain a sufficient growth of each isolate within the shortest time possible to insure a thorough inoculation during seedling time.

Before starting our cultural studies, however, it was necessary first to determine the purity of each isolate. For this work poured-plate cultures of Congo-red-mannitol agar prepared according to E. B. Fred et al.(6) and milk and potato slope cultures as recommended by Löhnis and Hansen(13) were employed. The common contaminant *B. radiobacter* produced small deep-red colonies on Congo-red-mannitol agar while the nodule organism did not. In this manner, the former can be separated from the latter quite successfully. The use of milk medium and potato slope also gave the same result. The nodule bacteria obtained from the Philippines produced no serum zone in milk and practically left the medium unchanged for a long time. The contaminant turned the milk brown and the potato slope, brownish gray.

The different isolates were then grown both in solid and liquid media. The former consisted of yeast-water mannitol agar, soil-extract-sucrose agar and soybean-extract agar, while the latter comprised milk and Buchanan's nutrient solution. The most apparent differences were the rate and abundance of growth of the different isolates on the different media. The best growths were noted on yeast-water mannitol agar. All the six isolates except the 7(u) produced thick or raised pearly white slimy growth on this medium. The culture 7(u), on the other hand, produced rather thin growth, later taking on a whitish appearance suggesting that its purity be further verified. In Buchanan's solution, the organism at the start produced fine cloudy mass which later on settled down at the bottom of the tubes.

Colony characters.—The colonies on the surface of yeast-water mannitol agar were circular, raised, smooth and moist, sometimes thin or dense, pearly white, transparent to translucent and hardly discernible from the medium unless held against a diffused light.

The embedded colonies or those below the surface of the medium were small, lens-shaped or ellipsoidal, dense and sometimes sharply pointed. The surface colonies were somewhat mucilaginous with age and ranged in diameter from 4 mm. and over. A more detailed report on the studies of the organisms will be given later in another paper.

Testing the cultures for nodule formation.—After getting the different isolates of the nodule bacteria well along in cultures, they were tested for their ability to produce nodules on the roots of soybeans. This test was accomplished through inoculation studies, which were repeated several times.

There were two methods of inoculation used in the present studies, each of which is presently discussed in detail below. One was to moisten the seeds with bacterial suspensions before sowing them in sterilized quartz sand in small crocks. These methods were previously employed by various investigators (6), (15), (17), and (18). The other method was to apply the inoculum on sterile Bryan's(3) modification of Crone nutrient solution[b] in bottles and flasks to which previously germinated seeds were planted. Controls, that is, cultures without the bacteria, were maintained for each set of inoculation studies.

In our nodulation (inoculation) experiments all the materials were sterilized. Thus the crocks containing the quartz sand which was slightly moistened with 10 per cent $CaCO_3$ were autoclaved at 15-pound pressure for at least five hours, while the seeds were disinfected with mercuric bichloride solution (1:1000) before sowing. For each set of several trials, there were 9 pots used, two for control and one pot each for every isolate tested. About ten seeds were sown in each pot. In some cases, however, only few seeds germinated and some of the plants even died before they were harvested. The control pots were planted first so as to avoid any possible contamination. The other pots were planted as soon as the seeds were inoculated by moistening each group of seeds by the water suspensions of each corresponding isolate. Great care was taken to avoid any one pot being contaminated by the other.

As soon as all the pots were planted and the sand moistened with sterilized Crone nutrient solution to about 50 per cent saturation, they were placed in the inoculation chamber in the glasshouse. The pots were first covered with a clean glass to avoid contamination. But as soon as the seeds had germinated and the seedlings had reached a height of about 5 cm. or more the pots were taken out and placed on a wooden bench keeping, however, the mouth of the pots well protected with clean cotton

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[b] Bryan's modified Crone nutrient solution consists of ingredients as follows: KCl—100 gms.; $MgSO_4.7H_2O$—25 gms.; $CaSO_4.2H_2O$—25 gms. $Ca_3(PO_4)_2$—25 gms.; $FePO_4$—25 gms. $\frac{3}{4}$ gm. of Na_2CO_3 was added to every liter of solution.

and black paper to conserve the moisture as well as to exclude the dust and thus avoid contamination. Only sterilized distilled water and Crone nutrient solution were used for watering the treated cultures as well as the controls, keeping the moisture content in each case as uniformly as possible. The two representative sets of quartz sand cultures, using Macoupin (plate 1, figs. 1 and 2) and Mis 33 Dixi, respectively, were included in the present paper.

In the absence of glass percolators, the solution cultures were carried out in liter-bottles and in 500 cc. Erlenmeyer flasks[c]. In preparing the solution cultures the seeds were not planted directly in the culture vessels but were first germinated aseptically in damp chambers cushioned in some cases with well sterilized moistened cotton and in others with moistened filter or blotting paper. As soon as the seeds have germinated and have developed roots long enough for the purpose, they were transferred to the culture vessels containing the sterilized nutrient solution. The bottles were provided with drainage holes at the bottom, and the flasks, with a sort of siphon. These devices facilitated the replacing of the old culture solution from both treated and controls which was done at least three times a week throughout the experiment. The seedlings were held in place with cotton plug (plates 2 and 3). The bottles were entirely covered with thick black paper, and placed in a box supported by a bench outside the glasshouse. The box was carefully lined with moist sphagnum moss to keep the solution culture cool during the hottest part of the day.

As soon as the plants approached maturity, that is, the pods were beginning to harden, those from the sand were carefully pulled up without breaking the roots or losing the nodules while those from the Crone nutrient solution were simply removed from the culture vessels in order to make the observations. The height, stand, vigor, and color of the plants, the number of nodules, their size and location on the root system were noted in both cases. The corresponding controls for each set of treatments were likewise studied. The results of the experiments are given in the tables below:

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[c] The vessels consisted originally of bottles, but some of them were broken during sterilization in the autoclave and the broken ones were substituted for flasks.

TABLE 1.—*Results of nodulation test with different isolates of soybean bacteria in Bryan's modification of Crone nutrient solution cultures using Macoupin variety (age of cultures, 1 month, 23 days)*

Isolate number	Total number of plants	Average number of nodules per plant: Main root	Lateral root	Total number of nodules	Shape and approximate size of nodules (Diameter in mm)	Average height of plants (cm)	Color of leaves of plants
1	3	--------	2	2	Spherical, 2-4	26.0	Pale green.
2	3	10	20	30	Spherical, 2-5	25.0	Pale green.
3	3	53	42	95	Spherical, 2-4	37.0	Deep green
4	3	15	18	33	Spherical, 2-4	27.0	Pale green.
5	3	50	10	60	Spherical, 2-4	33.0	Deep green.
6	3	45	35	80	Spherical, 2-5	28.0	Deep green.
7(u)	3	4	6	10	Spherical, 2-4	21.5	Pale green.
Control	3	--------	--------	--------	--------	20.0	Pale yellow.

TABLE 2.—*Results of nodulation and nitrogen fixation tests with different isolates of soybean bacteria in quartz sand cultures, using Macoupin variety (age 1 month and 29 days)*

Isolate number	Total number of plants [a]	Average number of nodules per plant: Main root	Lateral root	Total number of nodules	Shape and approximate size of nodules (Diameter in mm)	Average height of plants (cm)
1	5	10	22	32	Spherical, 2-5	32
2	9	15	25	40	Spherical, 2-5	42
3	7	46	26	72	Spherical, 2-7	56
4	6	18	18	36	Spherical, 2-8	43
5	8	38	18	56	Spherical, 2-6	50
6	7	40	20	60	Spherical, 2-5	48
7(u)	7	12	18	30	Spherical, 2-7	45
Control	5	--------	--------	--------	--------	23.5

Isolate number	Color of leaves of plants	Oven dry weight of plants in (gms)	Total nitrogen (Per cent)	Total nitrogen in the plants (mg)	Average nitrogen per plant (mg)	Average nitrogen fixed per plant over the control (mg)
1	Yellowish green	2.25	1.64	36.90	7.38	3.95
2	Green	4.20	1.35	56.70	6.30	2.87
3	Deep green	2.60	2.19	56.94	8.13	4.70
4	Green	1.60	1.89	30.24	5.04	1.61
5	Deep green	3.84	3.67	140.93	17.62	14.19
6	Deep green	2.35	4.31	101.29	14.47	11.04
7(u)	Green	1.50	1.64	24.60	3.51	0.08
Control	Pale green	1.57	1.095	17.19	3.43	--------

[a] Variability in the number of plants is due either to nongermination of seeds or death of plants before the close of the experiment.

TABLE 3.—*Results of nodulation and nitrogen fixation tests with different isolates of soybean bacteria in quartz sand cultures, using Mis 33 Dixi (age about 2 months)*

Isolate number	Total number of plants [a]	Average number of nodules per plant			Shape and approximate size of nodules (Diameter in mm)	Average height of plants (cm)
		Main root	Lateral root	Total number of nodules		
1	4	5	20	25	Spherical, 1-6	90
2	4	14	20	34	Spherical, 2-6	87
3	4	25	18	43	Spherical, 3-6	120
4	6	8	5	13	Spherical, 2-6	70
5	5	40	28	68	Spherical, 3-7	120
6	5	22	19	41	Spherical, 1-5	100
7(u)	3	2	4	6	Spherical, 1-3	70
Control	8	----------	----------	----------	----------	65

Isolate number	Color of leaves of plants	Oven dry weight of plants in (gms)	Total nitrogen (Per cent)	Total nitrogen in the plants (mg)	Average nitrogen per plant (mg)	Average nitrogen fixed per plant over the control (mg)
1	Pale green	1.92	1.51	28.99	7.25	1.54
2	Pale green	2.04	1.18	24.07	6.02	0.31
3	Greenish	2.54	2.02	51.31	12.83	7.12
4	Yellowish green	2.13	1.77	37.70	6.28	0.58
5	Deep green	2.82	3.09	87.14	17.43	11.72
6	Deep green	2.04	2.40	48.96	9.79	4.09
7(u)	Pale green	1.78	1.05	18.69	6.23	0.53
Control	Yellowish green	2.80	1.63	45.64	5.71	----------

[a] Variability in the number of plants is due either to nongermination of seeds or death of plants before the close of the experiment.

The results of our nodulation studies are given in tables 1, 2, and 3. Table 1 represents the average results of three sets of solution cultures using Macoupin variety while 2 and 3 give those of the quartz sand culture using Macóupin and Mis 33 Dixi, respectively. Each table indicates the number of nodules per plant and their location on the root system; and the general stand and vigor of the inoculated plants as compared with the controls.

The results of our inoculation tests showed that each of the isolates did not form nodules on the roots of the inoculated plants at uniform periods of time. While the plants in Crone nutrient solution inoculated with isolates 3, 5 and 6, respectively, produced a goodly number of nodules in 15 to 20 days (plate 3) those inoculated with isolates 1, 2, 4 and 7 (u) respectively, showed only slight nodulation in 20 to 30 days (plate 2). The sand cultures after a month or so of growth revealed the presence of

numerous fully developed nodules on the roots of the inoculated plants. These nodules from both solution and sand cultures varied in sizes from small mustard-seed-like to large spherical bodies, the latter often attaining a diameter of almost 7 mm. In general, each of isolates 3, 5 and 6 produced both large-and medium-sized nodules, the larger ones being usually formed on the main roots. On the other hand, the other isolates, namely, 1, 2, 4 and 7(u) each produced more or less uniform-sized nodules which were fairly well distributed on the root system. While nodulation was evident in all the inoculated plants, the controls from both quartz sand and the solution cultures did not produce nodules at all (plates 2 and 3).

Judging from our nodulation (inoculation) experiments (see tables 2, 3 and 4), isolates 3, 5 and 6, respectively, were the best inoculants not only on their influence on the nodulation period, stand and vigor of the host plant but also on the location of the nodules on the roots. The nodules produced by these isolates were not only comparatively numerous but also a majority of them tended to develop on the main roots. These findings seem significant in view of the possible relationship between the location of the nodules on the root system and the ability of the bacteria producing these nodules for mutualistic or symbiotic activities with the host plant. Some investigators(5) have advanced the idea that the organisms producing comparatively large nodules on the main or tap roots just below the surface of the ground are more effective in their task of fixing nitrogen than those that form nodules all over the root system.

Nitrogen-fixation test.—Baldwin(4) states that many strains of legume bacteria that ordinarily form nodules do not always help the host plant, or fix nitrogen. Bearing this fact in mind, the treated and control plants used in our nodulation experiment were analyzed separately for their total nitrogen content. Each set inoculated with each kind of isolate was analyzed separately and compared with the controls. From this test, it was possible to determine the ability of the individual isolates to fix nitrogen in the host plant. This information is essential as the ultimate aim of the present studies is to isolate the most active strain of the soybean nodule bacteria that is capable of giving the maximum benefit to the host plant as evidenced by increased nitrogen content of the plant, increased yield and improved quality of crops. The results of the analyses are shown in tables 2 and 3.

Tables 2 and 3 do not only show the degree of nodulation but also the amounts of nitrogen found in the plants after inoculating them with the different isolates from soybean as compared with their corresponding controls. A close study of tables 2 and 3 will show that the best results were obtained with the use of isolates 3, 5 and 6 on either Macoupin or Miss 33 Dixi varieties of soybean. It is also interesting to note that each of these isolates did not only show appreciable nitrogen fixation in the hosts but also developed abundant nodules as compared with isolates 1, 2, 4 and 7 (u) wherein, although each produced a good number of nodules, they did not assimilate nitrogen that far exceeded the nitrogen of the controls.

For example, the individual rates of assimilation of Macoupin inoculated with isolates 3, 5 and 6 varied, respectively, as 4.70 mg.; 14.19 mg. and 11.04 mg. while the individual nitrogen intake per plant with isolates 1, 2, 4 and 7(u) varied in the order that the isolates are herein named. On Mis 33 Dixi the individual rates of assimilation by the best isolates were as follows: Isolate 3, 7.12 mg.; Isolate 5, 11.72 mg.; and Isolate 6, 4.09 mg. The nitrogen intakes of isolates 1, 2, 4 and 7(u) were each only slightly over those of the control.

The results of these nitrogen fixation tests apparently indicate that out of the seven isolates so far obtained from the nodules of soybean plants only three at present are showing a good promise as effective inoculants for growing soybean under glasshouse conditions.

SUMMARY

1. The present paper gives the results of the isolation, nodulation (inoculation) and nitrogen fixation studies on the soybean nodule bacteria (*Rhizobium* sp.). A determinative study of the isolates is in progress.

2. Seven isolates of soybean nodule bacteria were used in these studies.

3. All the isolates except one which originated from a commercial culture imported from Urbana, Illinois, U. S. A. were obtained from sound nodules of young healthy plants of the Macoupin variety.

4. Although each of the isolates was capable of producing nodules on the roots of Macoupin and Mis 33 Dixi varieties of soybean, the nitrogen finally fixed in the host plant by each isolate varied in amounts. Thus, of the seven isolates tested

only three, namely, isolates 3, 5, and 6 were found to be desirable not only from the standpoint of nodule formation but also from the standpoint of ability to fix nitrogen in the host plant.

5. The nodulation tests were made on cultures grown in Bryan's modification of Crone nutrient solution and in quartz sand, while the nitrogen fixation determination was made on plants grown in the latter medium only.

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ILLUSTRATIONS

PLATE 1

FIG. 1. A general view of the individual quartz sand cultures of Macoupin variety about 2 months old, inoculated with isolates 1 to 3. Compare stand of the treated with that of the control.

FIG. 2. A general view of the individual quartz sand cultures of Macoupin variety about 2 months old, inoculated with isolates 4 to 7(u). Compare stand of the treated with that of the control.

PLATE 2

A general view of the individual cultures of Macoupin variety in Bryan's modification of Crone nutrient solution, about 1 month and 23 days old. Inoculated with isolates 1 to 7(u). Note the different stand of the individual cultures and the presence of nodules on the roots of the plants. Compare the treated with the control.

PLATE 3

A close-up of the best cultures in Bryan's modification of Crone nutrient solution inoculated with the promising isolates 3, 5, and 6. Note particularly the presence and location of nodules on the root system. Compare the treated with the control.

1

2

PLATE 1.

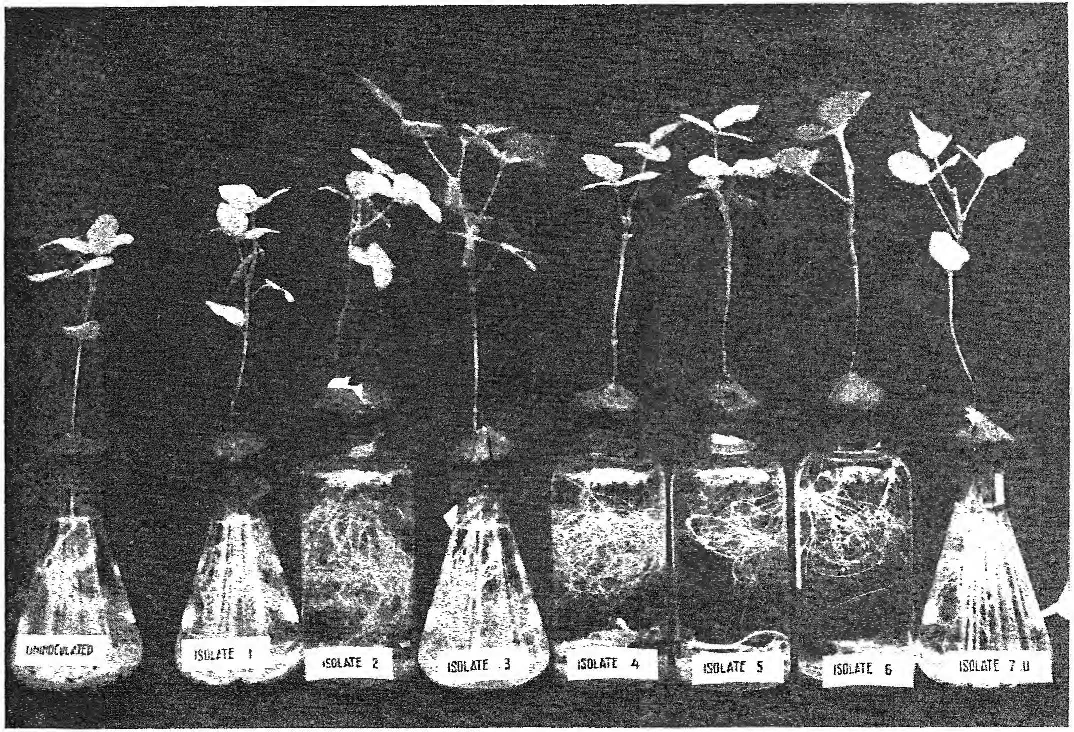
UNINOCULATED
ISOLATE 1
ISOLATE 2
ISOLATE 3
ISOLATE 4
ISOLATE 5
ISOLATE 6
ISOLATE 7 U

PLATE 2.

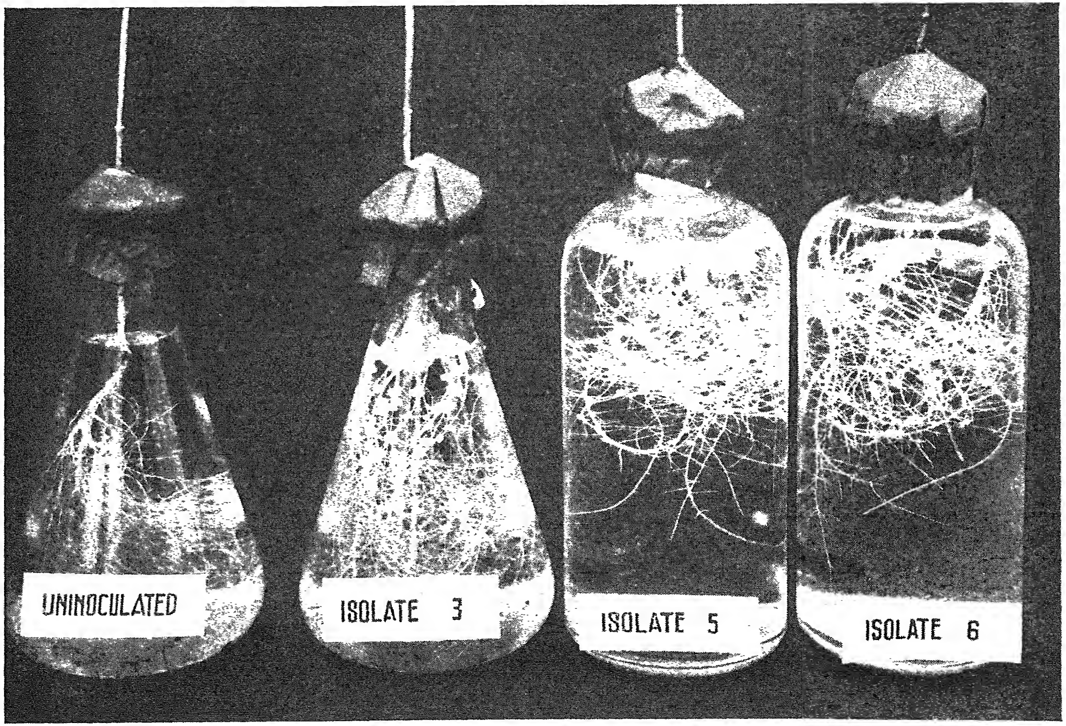

PLATE 3.

A COMPARATIVE TEST OF SOME PROMISING VARIETIES OF SOYBEAN[1]

By

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and

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FOUR PLATES

This study is a continuation of the work of the senior author on the acclimatization of soybean.[2] All the promising varieties found by him were taken as subjects in the present study. This step was taken because since the Bureau of Plant Industry undertook the acclimatization of soybean there has been a growing demand for some varieties that could be used for commercial planting. In order to meet this demand, it was necessary to conduct some field trial tests of the promising varieties already found. The object of the study, therefore, was primarily to determine the real value of the promising varieties of soybean when grown under field conditions. Simultaneously, it was desired to find some soybean varieties suitable to dry-season culture, because due to the hazards of rain at harvest time in the rainy season culture commercial growing of this crop would be more advantageous during the dry season.

The work was started in May, 1936, and the data here presented include those obtained up to April, 1939. The cultures were undertaken at the Lipa Coffee-Citrus Experiment Station, Lipa, Batangas, and at the La Union Provincial Nursery, Bangar, La Union.

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[1] Read by the senior author before the Fifth Philippine Science Convention (Division of Agriculture and Forestry) February 21–26, 1939.

[2] Rodrigo, P. A. Acclimatization of soybean in the Philippines: 1. Phil. Jour. Agr. 9 (1938) 223–252. 6 pls.

MATERIALS AND METHODS

The soybean varieties which were reported by the senior author as promising in his acclimatization tests were used in this study. There were 14 varieties, namely, American Black, Chinese, Dunfield, Hakubi, Illini, Kachin, Macoupin, Manchu, Mis 2 Behrum, Mis 28 E. B. Str. 3910, Mis 33 Dixi, Nanking, Otama-ao Str. 2, and Yellow Biloxi Hybrid.

In this study 12 cultures were made; eight of the cultures were undertaken at the Lipa Coffee-Citrus Experiment Station and four at the Provincial Nursery, Bangar, La Union. Four of the cultures in the Lipa Experiment Station were made during the rainy season, and the other four, during the dry season; while the four cultures in Bangar were made during the dry season.

All the cultures were run under field conditions. The fields were prepared for planting by plowing and harrowing them two or three times. Rows were prepared at 75 centimeters far apart and the seeds were planted at 25 to 30 centimeters apart in the rows with 4 to 5 seeds in a hill. The plants were later thinned to 2 or 3 per hill. In some of the cultures, however, the size of the plots was limited. Nevertheless, the plots for each variety which were arranged alternately were replicated at least from two to six times.

Cultivation was done by passing the plow between the rows at least two times. The weeds between the hills were hoed down. The dry season cultures at the Bangar Nursery were irrigated once each; this, however, could not be done at the Lipa Station for lack of adequate irrigation water.

At maturity, the plants were harvested by plots and the yields of grains determined accordingly.

EXPERIMENTS AND RESULTS

Lipa cultures.—Of the eight cultures in Lipa, only the four rainy season cultures gave good stand of crop; all the dry season cultures were poor and data were obtained from only two cultures. The plants were very small, attaining a height of about 15 to 25 centimeters only. The last culture of the rainy season planting, although it had an excellent stand, did not produce a good crop because of the severe attack of some leaf rollers and the soybean rust at the blooming stage. Tables 1, 2, 3, 4, 5, and 6 present the results of the Lipa cultures.

TABLE 1.—*Comparative grain yields of 70.4 sq. m. lots of some promising soybean varieties at the Lipa Coffee-Citrus Experiment Station (rainy season, 1936 culture)*

Plot number	Chinese	Dunfield	Hakubi	Illini	Macoupin	Manchu	Otama-ao Str. 2
	Kg.	*Kg.*	*Kg.*	*Kg.*	*Kg.*	*Kg.*	*Kg.*
1	5.37	8.10	4.10	5.42	11.77	9.77	9.40
2	6.65	6.90	2.70	2.74	9.81	6.95	6.26
3	6.29	8.56	6.16	4.71	11.47	9.85	6.59
4	5.02	8.05	6.35	3.25	11.96	7.90	8.98
5		6.44			10.65	7.97	8.76
Mean	5.83 ±0.24	7.61 ±0.28	4.83±0.36	4.03±0.31	11.13±0.26	8.47±0.31	8.00±0.34
S. D.	0.714±0.17	0.9270±.20	1.06±0.26	0.91±0.22	0.85±0.18	1.03±0.22	1.12±0.24
C. V.	12.24 ±3.21	12.18 ±2.62	21.94±5.49	22.58±6.67	7.61±1.63	12.16±2.62	14.00±3.02
Yield per hectare in:							
Kg.	828.1	1,081.0	686.1	472.4	1,438.9	1,203.1	1,136.3
Cav.	14.5	18.9	12.0	8.3	25.2	21.1	19.9

Planted .... June 4, 1936.

Harvested {August 14, 1936. / September 10, 1936}

Area of plot —70.4 sq. m.

TABLE 2.—*Comparative grain yields of some promising varieties of soybean*

Plot number	Dunfield	Macoupin	Manchu	Nanking	Otama-ao Str. 2	Yellow Biloxi Hybrid
	Kg.	*Kg.*	*Kg.*	*Kg.*	*Kg.*	*Kg.*
1	2.69	2.76	3.56	4.99	3.10	4.69
2	3.02	4.97	3.80	4.55	2.69	3.42
3	2.61	3.99	3.65	3.81	2.98	6.16
4	2.58	3.75	3.14	2.33	3.01	4.88
Mean	2.73±0.06	3.87±0.27	3.54±0.09	3.92±0.35	2.95±0.27	4.79± 0.60
S. D.	0.17±0.06	0.79±0.19	0.25±0.06	1.03±0.25	0.79±0.19	1.78± 0.42
C. V.	6.41±1.53	20.36±5.05	7.20±1.72	26.22±6.86	26.88±6.86	37.13±10.01
Computed yield per hectare in:						
Kg.	910.0	1,290.0	1,180.0	1,306.7	983.3	1,596.7
Cav.	16.0	22.6	20.7	22.9	17.2	28.0

TABLE 3.—*Comparative yields of 13 promising varieties of soybean at the Lipa Coffee-Citrus Experiment Station (May, 1937 planting)*

Plot number	Chinese	Dun-field	Hakubi	Illini	Kachin	Ma-coupin	Manchu	Mis 2 Behrum	Mis28 E. B. Str. 3910	Mis 33 Dixi	Nanking	Otama-ao Str. 2	Yellow Biloxi Hybrid
	Kg.	*Kg.*	*Kg.*	*Kg.*	*Kg.*	*Kg.*	*Kg.*	*Kg.*	*Kg.*	*Kg.*	*Kg.*	*Kg.*	*Kg.*
1	0.76	1.07	0.90	0.80	3.08	1.47	1.58	2.71	2.79	3.17	3.25	1.18	1.60
2	0.85	1.12	1.01	0.74	2.86	2.09	1.56	3.19	3.18	3.66	2.88	0.86	2.86
3	0.99	1.36	0.96	0.39	3.33	1.98	2.58	3.29	2.65	3.72	2.87	1.51	1.98
4	1.26	1.42	1.32	1.32	2.60	2.32	3.21	3.06	3.25	4.71	1.79	1.26	2.17
5	1.14	1.39	1.26	0.98	2.35	1.82	2.31	4.62	3.47	4.85	2.36	0.95	2.08
6	-------	1.72	1.12	-------	3.73	1.79	2.74	4.14	3.99	4.21	2.24	0.90	2.56
Mean	1.00	1.35	1.10	0.85	2.99	1.91	2.33	3.50	3.22	4.05	2.57	1.11	2.21
	±0.05	±0.06	±0.04	±0.08	±0.12	±0.07	±0.17	±0.18	±0.12	±0.16	±0.13	±0.08	±0.11
S. D.	0.18	0.21	0.15	0.30	0.45	0.27	0.60	0.66	0.14	0.59	0.48	0.28	0.40
	±0.04	±0.04	±0.03	±0.07	±0.09	±0.05	±0.12	±0.13	±0.09	±0.12	±0.09	±0.06	±0.08
C. V.	18.02	15.56	13.64	35.29	15.05	14.14	25.75	18.86	13.61	14.57	18.68	25.23	18.10
	±4.01	±3.08	±2.69	±8.47	±3.06	±2.78	±5.32	±3.79	±2.69	±2.90	±3.75	±5.21	±3.63
Computed yield per hectare in:													
Kg.	667	900	733	567	1,993	1,273	1,553	2,333	2,147	2,700	1,713	720	1,473
Cav.	11.7	15.8	12.9	10.0	34.9	22.3	27.2	40.9	37.7	47.4	30.1	12.6	25 8

TABLE 4.—*Grain yields of some promising soybean varieties at the Lipa Coffee-Citrus Experiment Station (May, 1938 planting)*

Plot number	American Black [1]	Head Green [3]	Yellow Biloxi Hybrid [2]	Mis 28 E. B. Str. 3910 [1]	Mis 33 Dixi [1]	Macoupin [2]	Mamloxi [3]	Nanking [3]	Ota-ma-ao Str. 2 [3]	Manchu [3]	Dunfield [3]	Hakubi [3]
	Kg.	*Kg.*	*Kg.*	*Kg.*	*Kg.*	*Kg.*	*Kg.*	*Kg.*	*Kg.*	*Kg.*	*Kg.*	*Kg.*
1	5.16	11.61	2.78	2.13	2.22	0.30	0.62	0.54	0.25	0.21	0.06	0.13
2	4.90	9.56	3.18	2.92	2.57	0.26	0.28	0.32	0.21	0.16	0.05	0.08
3	7.25	9.54	2.88	3.96	3.00	0.80	0.21	0.22				
4	10.89		1.43			0.39	0.38					
Mean	7.05	10.24	3.56	3.00	2.60	0.44	0.37	0.36	0.23	0.19	0.06	0.11
	±0.81	±0.37	±0.40	±0.29	±0.42	± 0.07	± 0.05	± 0.05	±0.01	±0.01	±0.01	±0.01
S. D.	2.39	0.89	1.19	0.74	0.31	0.21	0.15	0.13	0.02	0.02	0.01	0.02
	±0.57	±0.24	±0.29	±0.25	±0.09	± 0.05	± 0.04	± 0.04	±0.01	±0.01	±0.03	±0.01
C. V.	33.90	8.69	33.43	24.67	11.92	47.73	40.54	36.11	8.69	10.53	16.67	18.18
	±8.84	±2.40	±8.80	±7.16	±3.33	±13.70	±11.15	±11.16	±2.93	±3.62	±5.73	±6.32
Average yield per hectare in:												
Kg.	334	776.0	121.0	227.0	197.0	21.0	264.0	257.0	164.0	136.0	43.0	79.0
Cav.	5.9	13.6	2.1	4.0	3.5	0.4	4.6	4.5	2.9	2.4	0.8	1.4

[1] The plots had an area of 132 sq. m. each.
[2] The plots had an area of 211 sq. m. each.
[3] The plots had an area of 14 sq. m. each.

TABLE 5.—*Comparative yields of some promising soybean varieties at the Lipa Coffee-Citrus Experiment Station when planted during the dry season, November 12, 1938*

Plot number	American Black	Head Green	Ami Yellow	Mis 33 Dixi	Mis 28 E. B. Str. 3910
	Kg.	*Kg.*	*Kg.*	*Kg.*	*Kg.*
1	0.85	1.37	0.57	0.39	0.35
2	0.81	1.56	0.65	0.43	0.37
3	0.83	1.45	1.03	0.61	0.61
M.	0.83±0.01	1.46±0.03	0.75±0.07	0.48±0.04	0.44±0.04
S. D.	0.02±0.006	0.07±0.02	0.19±0.05	0.09±0.02	0.11±0.03
C. V.	2.41±0.67	4.79±1.32	25.33±7.42	18.75±5.33	25.00±7.32
Yield per hectare in:					
Kg.	62.9	110.6	56.8	36.3	33.0
Cav.	1.10	1.94	1.00	0.64	0.58

TABLE 6.—*Comparative yields of some promising soybean varieties at the Lipa Coffee-Citrus Experiment Station when planted during the dry season, December 7, 1938*

Plot number	American Black	Ami Yellow	Head Green	Mis 28 E. B. Str. 3910	Mis 33 Dixi	Mis 2 Behrum	Kachin
	Kg.	*Kg.*	*Kg.*	*Kg.*	*Kg.*	*Kg.*	*Kg.*
1	0.25	0.40	0.55	0.31	0.25	0.10	0.08
2	0.35	0.28	0.70	0.30	0.31	0.09	0.08
3	0.47	0.52	0.71	0.32	0.30	0.13	0.13
Mean	0.36±0.04	0.40±0.04	0.65±0.03	0.31±0.004	0.29±0.008	0.11±0.004	0.09±0.008
S. D.	0.09±0.02	0.09±0.02	0.07±0.02	0.01±0.003	0.02±0.006	0.01±0.003	0.02±0.006
C. V.	25.00±7.32	22.50±6.47	10.77±3.01	3.22±0.89	6.90±1.91	9.09±2.51	22.29±6.39
Yield per hectare in:							
Kg.	64.3	71.4	116.1	55.4	51.8	19.6	16.1
Cav.	1.13	1.25	2.04	0.97	0.91	0.34	0.28

Bangar Nursery cultures.—As already stated, the four cultures made in the Bangar Nursery were undertaken during the dry season. With the exception of the first culture which was overtaken by the early rains in May and June, thus causing it to have a rank growth, all the cultures had good stand and produced good crop of grains.

Tables 7, 8, and 9 present the results of the last three dry season cultures at the Provincial Nursery in Bangar, La Union. The first culture did not produce any seed as already stated. Table 10 is a summary of tables 1, 2, 3, and 4, while table 11 is a summary of tables 7, 8, and 9.

TABLE 7.—*Yield of three promising dry season varieties of soybean at the Provincial Nursery, Bangar, October 10, 1938 planting*

Plot number	Mis 33 Dixi	Mis 28 E. B. Str. 3910	American Black	Head Green
	Kg.	*Kg.*	*Kg.*	*Kg.*
1	1.4	2.5	1.9	3.2
2	1.8	1.5	1.3	2.5
3	1.9	1.4	1.1	2.5
4	1.5	1.5	1.4	2.1
5	1.8	1.7	1.0	2.8
Mean	1.68±0.06	1.72±0.17	1.34±0.15	2.42±0.17
Standard deviation	0.19±0.04	0.55±0.12	0.50±0.11	0.57±0.12
C. of variability	11.31±2.49	31.97±7.43	37.16±8.88	23.63±5.29
Days to mature	90	90	86	90
Height of plants in cm.	98.3	94.5	66.8	117
Computed yield per hectare in:				
Kg.	1,200	1,228	957	1,729
Cav.	21.1	21.5	16.8	30.3

TABLE 8.—*Yield of four promising dry season varieties of soybean at the Provincial Nursery, Bangar, October 25, 1938 planting*

Plot number	Mis 33 Dixi	Mis 28 E. B. Str. 3910	American Black	Head Green
	Kg.	*Kg.*	*Kg.*	*Kg.*
1	1.1	1.3	1.1	1.5
2	1.0	1.2	0.9	1.3
3	1.3	0.9	0.8	1.2
4	0.9	0.8	1.1	0.9
5	0.9	1.2	1.0	1.1
Mean	1.04±0.04	1.08±0.06	0.98±0.03	1.20±0.06
Standard deviation	0.14±0.03	0.19±0.04	0.11±0.02	0.20±0.04
C. of variability	13.46±2.96	19.39±4.35	11.22±2.42	16.67±3.70
Days to mature	96	96	88	96
Height of plants in cm.	95.8	93.4	60.2	101.5
Computed yield per hectare in:				
Kg.	744	771	700	857
Cav.	13.1	13.5	12.3	15.0

TABLE 9.—*Yield of four promising dry season varieties of soybean at the Provincial Nursery, Bangar, November 3, 1938*

Plot number	Mis 33 Dixi	Mis 28 E. B. Str. 3910	American Black	Head Green
	Kg.	*Kg.*	*Kg.*	*Kg.*
1	1.0	1.1	1.0	1.3
2	0.8	1.0	0.9	1.0
Mean	0.9±0.048	1.05±0.024	0.95±0.024	1.20±0.048
Days to mature	94	94	86	94
Height of plants in cm.	90.1	88.4	63.6	95.8
Computed yield per hectare in:				
Kg.	643	750	678	857
Cav.	11.3	13.2	11.9	15.0

TABLE 10.—*Average yield per hectare of four rainy season cultures at the Lipa Coffee-Citrus Experiment Station*

Variety name	Culture number				Average yield per hectare	
	1	2	3	4 [a]		
	Kg.	*Kg.*	*Kg.*	*Kg.*	*Kg.*	*Cav.* [b]
American Black				334.0		
Chinese	828.1		667.0		747.6	13.6
Dunfield	1,081.0	910.0	900.0	43.0	963.7	16.9
Hakubi	686.1		733.0	79.0	709.6	12.4
Head Green				776.0		
Illini	472.4		567.0		519.7	9.1
Kachi n			1,993.0		1,993.0	34.9
Macoupin	1,438.9	1,290.0	1,273.0	21.0	1,333.9	23.4
Mamloxi				264.0		
Manchu	1,203.1	1,180.0	1,553.0	136.0	1,312.0	23.0
Mis 2 Behrum			2,333.0		2,333.0	40.9
Mis 28 E. B. Str. 3910			2,147.0	237.0	2,147.0	37.7
Mis 33 Dixi			2,700.0	197.0	2,700.0	47.4
Nanking		1,306.7	1,713.0	287.0	1,509.5	26.4
Otama-ao Str. 2	1,136.3	983.3	720.0	164.0	946.5	16.6
Yellow Biloxi Hybrid		1,596.7	1,473.0	121.0	1,534.9	26.9

[a] The low yield was due to the severe attack of soybean leaf roller and soybean rust. The yield obtained in this culture was not used in computing the average per hectare.

[b] One cavan of soybean weighs 57 kilograms.

TABLE 11.—*Average yield per hectare of three dry season cultures of some promising varieties of soybean at the Provincial Nursery, Bangar, La Union*

Variety name	Culture number [a]			Average yield per hectare	
	1	2	3		
	Kg.	*Kg.*	*Kg.*	*Kg.*	*Cav.*
American Black	957	700	678	778.3	13.6
Head Green	1,729	857	857	1,147.7	20.1
Mis 28 E. B. Str. 3910	1,228	771	750	916.3	16.1
Mis 33 Dixi	1,200	744	643	863.3	15.1

[a] Culture No. 1 was planted on October 10, 1938.
Culture No. 2 was planted on October 25, 1938.
Culture No. 3 was planted on November 3, 1938.

DISCUSSION OF RESULTS

LIPA CULTURES

Rainy season.—The four rainy season cultures at the Lipa Coffee-Citrus Experiment Station had very good stand. With the exception of the last which was badly damaged by soybean leaf rollers and bean rust, all the cultures had good grain yields, as seen in tables 1 to 4. In the first culture where seven varieties were tested, the yield varied from 472.4 to 1,438.9 kilograms (8.3 to 25.1 cavans) per hectare. The four best yielders were Macoupin, Manchu, Otama-ao Str. 2, and Dunfield. The average yields ranged from 1,081 to 1,438.9 kilograms (18.9 to 25.2 cavans) per hectare. In the second culture where 6 varieties were tested, the best four were Yellow Biloxi Hybrid, Nanking, Macoupin, and Manchu. Their yields ranged from 1,180 to 1,596.7 kilograms (20.7 to 28 cavans) per hectare. It will be noticed that Otama-ao Str. 2 and Dunfield were replaced by Yellow Biloxi Hybrid and Nanking, but Macoupin and Manchu still persisted as two of the best four.

As seen in table 3, 13 varieties were included in the third culture; the yield varied from 567 to 2,700 kilograms (10.0 to 47.4 cavans) per hectare. In this test, new additional promising varieties found by the senior author were included. Of the 13 varieties, eight (8) gave an average yield of over 20 cavans per hectare—ranging from 1,273 to 2,700 kilograms (22.3 to 47.4 cavans). The varieties in the ascending order of their yields are Macoupin, Yellow Biloxi Hybrid, Manchu, Nanking, Kachin, Mis 28 E. B. Str. 3910, Mis 2 Behrum, and Mis 33 Dixi. Kachin, Mis 28 E. B. Str. 3910, Mis 2 Behrum, and Mis 33 Dixi were the

four highest yielders in this test. All these varieties were introduced from India. From the standpoint of commercial value, because of the uniformity of grains and their attractive bright straw color, Mis 28 E. B. Str. 3910 and Mis 33 Dixi are the better of the high-yielding varieties. Their seeds, however, are not as big as those of Macoupin, Yellow Biloxi Hybrid, Manchu, and Nanking, particularly the first two. Kachin and Mis 2 Behrum have small beans which are very variable in size. They are also late maturing.

In the last culture, although the harvest was very poor because of the attack of some pests and diseases at the blooming stage, as already stated, two new varieties have shown some promise—Head Green and American Black. These are small-seeded but nevertheless uniform. The first has green seed which fades to straw color upon aging and the second has black seed.

Taking the four rainy season cultures as basis for comparison, the eight heaviest yielders at the Lipa Coffee-Citrus Experiment Station were Kachin, Macoupin, Manchu, Mis 2 Behrum, Mis 28 E. B. Str. 3910, Mis 33 Dixi, Nanking, and Yellow Biloxi Hybrid. Head Green and American Black, because of their fine showing in the last cultures as compared with the other varieties, may be included among the best. For commercial growing, however, preference may be given to Yellow Biloxi Hybrid, Mis 33 Dixi, Macoupin, Mis 28 E. B. Str. 3910, and Manchu because of their attractive grains.

Dry season.—As already stated, four cultures were undertaken. All the 14 varieties tested during the rainy season were included in these tests. On the basis of the stand of the cultures, these were considered failure because the tallest plants grew to a height of about 15 to 25 centimeters only with few pods. As seen in tables 5 and 6 which summarize the results of the last two dry season cultures, the highest computed yield per hectare was only two cavans. The poor growth of the plants must not have been due to lack of moisture since rainfall in Lipa is still abundant in the months of November, December, and January. It is possible that the comparatively low temperature in Lipa during this time of the year might have been the limiting factor. In Manchuria and in the United States, soybean grows best during the summer months.

BANGAR CULTURES

The four dry season cultures at the Provincial Nursery, Bangar were all successful in so far as growth of the four varieties tested

was concerned. The plants did not grow lower than 60 centimeters. The first culture, however, failed to produce a good crop of seeds; the pods were practically all empty. This behavior of the plants might have been due to the sudden change in the moisture condition of the soil, because the culture was overtaken by strong rains in May while the plants were in bloom. Or it might have been due to the attack of some sucking bugs, like *Riptortus atricornis* Stal., as has been observed in some cultures at the Los Baños Economic Garden.

The three other cultures, which were planted on October 10 and 25 and November 3, 1938, had good stand and yield of grains of excellent quality. In the October 10 planting, the yield of grain varied from 957 to 1,729 kilograms (16.8 to 30.3 cavans) per hectare with Head Green as the best yielder, followed by Mis 28 E. B. Str. 3910 and Mis 33 Dixi. American Black was the poorest in yield, the earliest-maturing and the shortest in height (see table 7). In the October 25 planting, the plants were slightly smaller and less productive in yield than the October 10 planting. Nevertheless the grains were of excellent quality. The yield in this culture varied from 700 to 857 kilograms (12.3 to 15.0 cavans) per hectare (table 8). In the November 3 planting, the yield varied from 643 to 857 kilograms (11.3 to 15 cavans) per hectare. The relative yielding powers of the varieties were more or less maintained in the three cultures.

Based on the average of the three cultures, the yield of the four varieties tested ranged from 778.3 to 1,147.7 kilograms (13.6 to 20.1 cavans) per hectare with Head Green as the best yielder, followed by Mis 28 E. B. Str. 3910 and Mis 33 Dixi, while American Black was the poorest (see table 11). These results are very significant as they show the great potentialities of soybean as a dry season crop in some sections of the country. Here is a crop of great importance as food, as feed, and as a soil renovator that shows great promise as a rotation crop with both the upland and lowland rice. A thorough study of the regions where soybean could be grown as a dry season crop and of the varieties suitable for the purpose should be undertaken. Under La Union conditions, Head Green, Mis 33 Dixi, and Mis 28 E. B. Str. 3910 are adaptable for dry season culture.

SUMMARY

1. The present work embraces a three-year field test consisting of 12 cultures of some promising varieties of soybean. Eight

of the cultures were made at the Lipa Coffee-Citrus Experiment Station; and the other four, at the Provincial Nursery, Bangar, La Union.

2. From the results of the cultures at the Lipa Coffee-Citrus Experiment Station, only the rainy season tests (May plantings) were successful; the different varieties are not adapted to the prevailing conditions during the dry season. At the Provincial Nursery in Bangar, La Union, the dry season cultures were good.

3. Of the 14 varieties tested at the Lipa Coffee-Citrus Experiment Station during the rainy season, 8 varieties gave yields ranging from 23 to 47.4 cavans per hectare as average of one to three cultures. These varieties, in their descending order, are Mis 33 Dixi, Mis 2 Behrum, Mis 28 E. B. Str. 3910, Kachin, Yellow Biloxi Hybrid, Nanking, Macoupin, and Manchu.

4. Mis 2 Behrum and Kachin are late-maturing varieties; their beans are small and also very ununiform.

5. The results of the dry season planting of soybean at the Bangar Provincial Nursery show the great possibility of this crop in certain sections of the country.

6. Of the four varieties tested at the Bangar Provincial Nursery, three may be considered good for commercial planting during the dry season, namely, Head Green, Mis 28 E. B. Str. 3910, and Mis 33 Dixi. The corresponding yields of these varieties as average of three cultures were 20.1, 16.1, and 15.1 cavanes per hectare. Mis 33 Dixi and Mis 28 E. B. Str. 3910, because of the desirable color (bright straw) of their grains which are bigger than those of the Head Green, may be given preference in the choice of varieties.

ILLUSTRATIONS

PLATE 1

FIG. 1. A view of the 1936 rainy season comparative test at the Lipa Coffee-Citrus Experiment Station, Lipa, Batangas.

FIG. 2. A view of the 1937 rainy season culture at the same station.

PLATE 2

FIG. 1. A view of the 1933 rainy season culture (Lipa Coffee-Citrus Exment Station).

FIG. 2. A view of the same field in fig. 1 after the plants have been badly attacked by leaf rollers. Note how the plants have been defoliated.

PLATE 3

A view of the 1938–39 dry season planting at the Lipa Coffee-Citrus Experiment Station, Lipa, Batangas. Note the dwarfed plants.

PLATE 4

FIG. 1. A view of the 1938–39 dry season plantings at the Provincial Nursery, Bangar, La Union. Note the vigor of the plants.

FIG. 2. Some typical plants at maturity of the four varieties tested in fig. 1. The plants become "naked" as they mature.

1

2

PLATE 1.

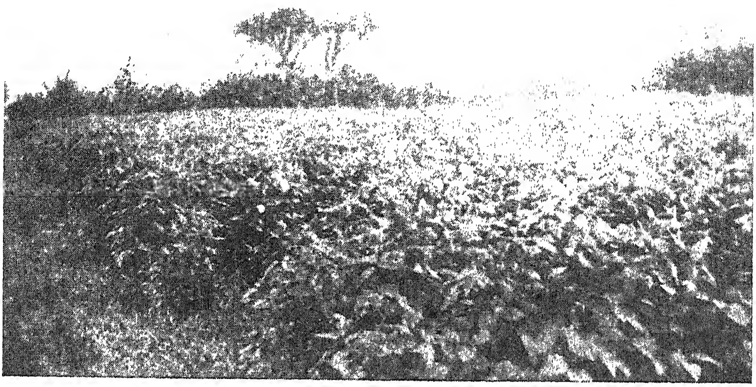

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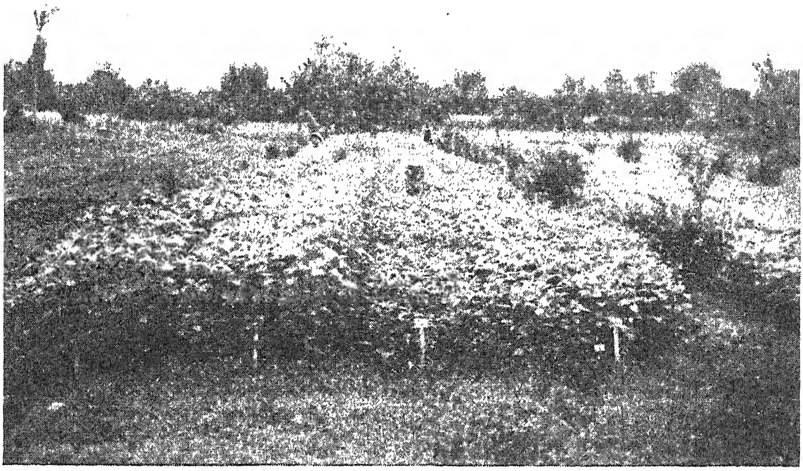
PLATE 2.

PLATE 3.



1

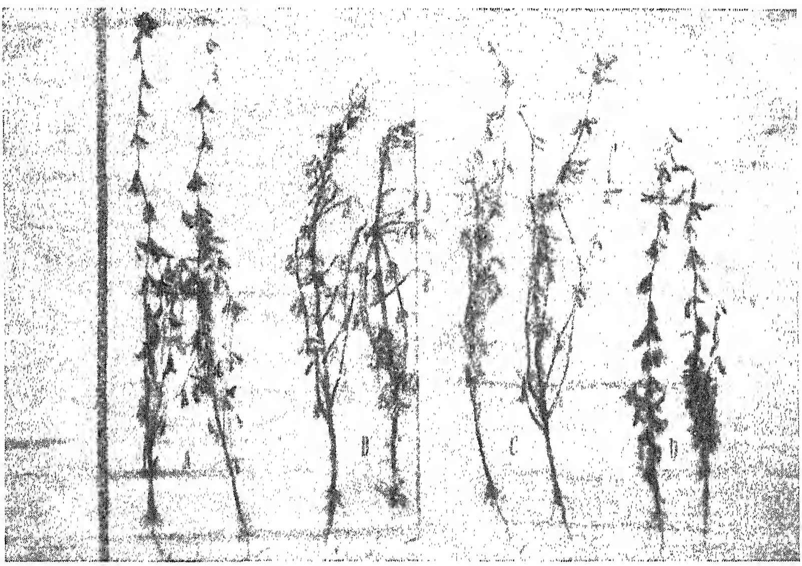


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PLATE 4.

BERMUDA ONION (*ALLIUM CEPA*)[1]

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THREE PLATES

Bermuda onion is a variety of the big-bulbed onion which is commonly called in Tagalog as "Sibuyas Bombay." It derived its name from Bermuda Islands where it is largely grown for export. The onion, *Allium cepa,* is regarded as a native of Western Asia, and is commonly cultivated in India, China, and Japan. It is one of the earliest of cultivated plants and was even represented in Egyptian monuments.

Available records from the Bureau of Plant Industry place the introduction of "Sibuyas Bombay" into the Philippines in 1911 (from Australia) and again in 1919 (from the United States). Onion seeds from Japan, British India, Egypt, Germany, Great Britain, and the Canary Islands were also introduced here, but it was only in 1934, however, that we have been successful in our commercial ventures toward the cultivation of Bermuda onion, especially with seeds imported from the Canary Islands and India.

The growing of Bermuda onion has been found best in the Central Luzon provinces, such as Bulacan, Nueva Ecija, Pampanga, and Tarlac; Pangasinan, Cavite, Batangas; and the Ilocos Provinces (Ilocos Norte, Ilocos Sur, and La Union).

The table given below shows briefly the results of growing Bermuda onion in the Philippines as conducted by the Bureau of Plant Industry during the eight-year period 1931–1939.

[1] To be reprinted as Farmers' Circular No. 2.

TABLE 1.—*Results of Bermuda onion growing in the Philippines*

Season	Quantity of seeds	Area	Production	Approximate value
	Kilos	*Ha.*	*Kilos*	*Pesos*
1931-32	12	1.5	7,500	----------
1932-33	200	20.0	60,000	----------
1933-34	900	176.0	240,655	14,439
1934-35	1,000	102.5	137,163	8,230
1935-36	1,337	234.0	720,000	52,000
1936-37	1,030	189.3	1,105,335	88,400
1937-38	1,300	215.3	1,379,374	110,300
1938-39	2,435	459.8	1,655,058	115,854

NOTE: The 1939 onion crop was affected by thrips.

The steady progress in raising native Bermuda onion in different provinces has so far affected to some degree our total onion imports during the last few years.

The Philippine importation of onions is worth more than half a million pesos annually, or a total of about 11,000,000 kilos. Based upon the 1938 yield (6,400 kilos) per hectare, it will require to plant here about 1,720 hectares in order to cut off our annual imports. This area is easily available in the lowland rice regions of the Central Luzon provinces.

The importation of onion into the Philippines during the eight-year period 1931–1938 from Japan, United States, Egypt, Dutch East Indies, Australia, China, British East Indies, etc. is given in table 2.

TABLE 2.—*Importation of onions into the Philippines (1931–1938)*

Year	Quantity	Value	Customs duty
	Kilos	*Pesos*	*Pesos*
1931	13,962,147	626,152	----------
1932	12,107,395	529,924	----------
1933	9,854,056	408,779	105,211
1934	11,565,242	504,199	155,490
1935	13,480,276	429,964	255,024
1936	11,780,844	545,672	197,900
1937	10,637,492	505,203	204,114
1938	12,299,021	722,888	223,937

A duty is levied on onions imported into the Philippines from foreign countries at the rate of ₱2.00 per 100 kilos except those imported direct from the United States which are free of charge.

CLIMATIC REQUIREMENTS

Like many other plants, there are varieties of onions adapted to different climatic conditions. Onion which grows well in a cold climate is not suitable to grow under tropical conditions.

In the Philippines the climate most suitable to the proper development of Bermuda onion is both mild and dry or a distinct dry and wet season. Active growth takes place during the period of mild weather, from October to January. Planting should be done during the month of October so that maturing falls during the dry months, from February to April, the period when curing is easier and a better keeping quality of the products is insured.

The amount of rainfall required by this crop depends primarily upon the capacity of the soil to retain its moisture content. Sandy and porous soils require much rainfall while peat and muck soils, where the water remains near the surface, require less rainfall. Too much rainfall tends to develop vegetative growth at the expense of bulb formation. Besides, the rainy weather is not favorable for maturing, drying, and storing of the bulbs. Onions produced under excessive rainfall or too frequent irrigations possess poor keeping quality.

The presence of drought is not a serious problem in the growing of onion, because most of the lands recommended for planting have available water supply for irrigation or are in places where the water table is shallow. However, intense drought is destructive to onion plants, as it affects the source of water supply.

The occurrence of flood and typhoon is also destructive to onion plantings, especially during the seedling stage. It is, therefore, necessary that seedbeds should be located on a high and level place and protected by windbreaks. Tse sowing of seeds should be done after the period of frequent typhoons and floods in the locality.

In the highlands of Batangas and Cavite and in the Trinidad Valley, Baguio, Mountain Province, where the climate is humid and cool, the growing of Yellow Bermuda variety has been tried with less success.

SOIL REQUIREMENTS

Bermuda onion is one of the hardiest of the vegetable-garden plants. It has been observed that it grows in any kind of soil

as long as it is well drained and supplied with adequate moisture. On poor soil, the bulbs produced are small and hard, while on very rich soil they are bigger and possibly softer, but with poor keeping quality. An ideal soil for Bermuda onion must be porous, mellow, and friable with adequate available plant food.

Preference should be given to low-lying lands along river borders or along the coasts which are predominantly silty loam formed by occasional inundations. This soil is productive even without irrigation, but if the water level is too low, it requires irrigation to maintain sufficient moisture for a successful crop. Alluvial surface soil and clay subsoil evenly admixed with fine gravel is good for onion. Red sandy soil and dark chocolate loams are good soils for quick-maturing crops. Soils that are not sticky and could be easily cultivated may grow onion any time. The lowland rice region, where the soil is loamy, fertile, and with available irrigation water, is the best to grow onion on a commercial scale.

Onion grows successfully from sea level to higher altitudes and from level to rolling lands provided the climatic conditions in the locality are favorable for its growth. Fairly good crops of Bermuda onion are produced every year from the strip of level land along the lake borders of Lemery and Taal, Batangas. A better quality and greater quantity of onions are grown in the irrigated lowland rice region of Muñoz and in the rolling lands at Calaanan, Boñgabon, Nueva Ecija.

VARIETIES

There are several known varieties of big-bulbed onions which have been tried here successfully, namely, Crystal Wax, Red Bermuda, Yellow Bermuda (often called the White Bermuda), Red Globe, etc. But the two varieties which are popularly known at present are the Yellow Bermuda and Red Globe.

The Yellow Bermuda is the principal variety grown here extensively. It is smooth, flat, regular in size, and with a mild or sweet taste. It can withstand unfavorable weather conditions and is one of the most productive. Its keeping quality is fairly good provided it is harvested when fully matured and well cured under the shed. Like the Yellow Bermuda, the Red Globe variety is also productive and even more hardy in its growth under hot climatic condition. It has a shiny red skin, is more compact,

and with regular shape and size. The taste is slightly pungent and the texture is somewhat tough even when cooked. The Red Globe has a keeping quality superior to that of the Yellow Bermuda. But due to the high cost of the seeds of the Red Globe variety, which is more than twice that of the Yellow Bermuda, many planters are reluctant to plant the former in big areas.

PROPAGATION

Methods of propagation.—Bermuda onion may be propagated (*a*) by seed, (*b*) by seedlings, and (*c*) by sets.

(*a*) *Propagating by seed* is meant the planting of seeds directly into the field. When the field has been already prepared and the rows are already made, the seeds are drilled. From 18 to 24 grams of seeds may be sown per 100 meters of row, and from 3 to 4 kilos are sufficient to plant a hectare. About two weeks after planting when the plants are about 10 cm. high, they should be thinned to about 7–10 cm. apart in the row. Direct planting is preferable on rolling lands and in places where the growth of weeds is not too thick.

(*b*) *By seedlings.*—Seedlings are young onion plants produced from seeds which are sown in seedbed and allowed there for about 5 to 7 weeks before transplanting to the field. Vigorous and stocky seedlings should be selected for transplanting. The planting of onion by seedlings known as transplanting method is very popular among onion planters.

(c) *By sets.*—Sets are small onion bulbs about 2 to 3 cm. in diameter resulting from arrested growth or from too thick planting. To produce sets, the seeds are sown thickly on rather poor soil at the rate of about 7 grams to a square meter. The young plants, when they grow, cannot develop bulbs fully, for lack of space and moisture; thus, growth is arrested. The sets are harvested, cured, and kept in a cool dry place for the next planting season. The planting of sets in the Philippines is not yet practiced. However, in the temperate regions, like the United States, Japan, etc., this method of planting is very common and well undertaken in a big-scale production to provide the early crop.

Seed production.—Under ordinary field conditions the Yellow Bermuda onion plants which grow directly from seeds do not show any flower when they reach maturity, unlike the Red Globe variety, Crystal Wax, etc., which are capable of producing

flowers. Plants from seeds very seldom, if at all, produce any seed during the first year. In the United States the common practice is to produce "mother bulbs" from seeds during summer. Then the "mother bulbs" are stored over winter and then planted the following spring for the production of seeds. "Mother bulbs" are medium-sized bulbs (4–5 cm. in diameter); they are produced by planting the seeds or seedlings rather thick in the field.

The Bureau of Plant Industry conducted almost a two-year study (from May, 1933 to April, 1935) on the production of onion seeds under local conditions and obtained the following important results:

(1) The ability of the onion plant to flower under Philippine conditions seemed to be a varietal characteristic. Of the seven untreated "mother bulbs" of different varieties, only three showed signs of flowering.

(2) The flowering of onion was accelerated by storing the "mother bulbs" first in cold storage (10°C.) for a period of 28–71 days. Plants from "wintered mother bulbs" flowered earlier and had higher percentage of flowering than plants from non-wintered bulbs.

(3) Of the six varieties that flowered, only three (Red Globe, Red Brown Bombay, White Bombay) actually produced seeds. The seeds produced when tested a couple of weeks after harvesting were found viable. The seeds of Brown Bombay when planted grew to maturity.

Seeds for planting and its preservation.—The Bureau of Plant Industry imports fresh stock of such onion seeds as Yellow Bermuda from the Canary Islands and Red Globe from India so as to reach the Philippines about the latter part of September. The seeds are distributed at cost to different farmers.

The seeds which weigh 100 lbs. are packed in tin containers which are tightly enclosed in a box. The seeds are first tested before distributing them to planters. Generally, the seeds give from 85 to 98 per cent of germination.

Like many other vegetable seeds, onion under ordinary conditions loses its viability after a certain period of time, so much so that when planted the next season only a limited percentage will germinate. The Bureau of Plant Industry preserved onion seeds in cold storage (50°–60° F) and or in an air-tight petroleum can, sealed with paraffin and containing 3 or 4 balls of naphthalene.

CULTURAL METHODS

Planting in seedbeds.—The sowing of seeds is commonly done during October and November. For a hectare of land, from 2½ to 3 kilos of onion seeds are required. Each kilo of seeds requires a seedbed of from 150 to 200 square meters.

The soil for seedbed should be friable, fertile, and loamy. It should be in a state of fine tilth and well sterilized by drying thoroughly under the sun or by burning trashes on it. The size of the seedbed is from 50 to 100 cm. wide with any convenient length and raised to 15 cm. above the path.

The seeds should be sown thinly and uniformly and covered well with a layer of fine soil about 1 cm. thick, and then watered thoroughly. The top soil is kept moist by putting on it rice straw or portable shade. From 3 to 5 days the seeds will germinate. But before the seeds germinate, the red ants may carry or destroy them especially those that are not well covered with soil. To prevent destruction by ants, rice shorts (binlid), ground corn, etc., are spread along the edges of the seedbed to attract the ants, thereby keeping them away from the onion seeds until they germinate. Calcium cyanide may also be used to get rid of ants.

To hasten germination as well as to test the percentage of viability of the seeds, it is necessary that they should be soaked first in water for at least over a night before sowing. Seeds that are certain of germination increase in size with cracked outer skin.

Rice straw or portable shade is used to protect the young seedlings from too intense heat or too excessive rain, as both adversely affect the growth of the seedlings. The rice straw is removed partially every day when the seedlings begin to sprout. About 4 days after the seeds have already germinated, the straw is completely removed and the seedlings are allowed to grow under complete exposure. The portable shade is removed after the rain. Weeds should not be allowed to grow as they crowd out and disturb tender seedlings.

The critical stage in the life of the young seedlings is during the time when they have just germinated. Too much watering encourages damping-off disease, and once developed it becomes fatal to the young seedlings. Lack of sufficient water may cause stunted growth, which finally dries off the seedlings.

The seedbed is watered just enough to keep the seedlings grow evenly and vigorously. A dressing of from 6 to 8 table spoon-

fuls of ammonium sulphate fertilizer dissolved in a petroleum canful of water should be applied when the seedlings are about two weeks old. This application should be done 3 or 4 times at intervals of about a week or more. From 5 to 7 weeks after sowing they are ready for transplanting.

Preparation of the field.—The field should be prepared thoroughly and much ahead of time before transplanting. It should be free from weeds and stumps, and the soil should be in a good state of tilth. The preparation of the field for planting in the rice paddies with straw mulch is discussed under a separate topic.

Fertilizers and green manuring.—The onion plants require a fertile soil, but a very fertile soil tends to produce big and thick-necked bulbs of poor quality. Any type of soil which is adequately manured is good for onion. Stable manure should be applied at the rate of from 5 to 10 tons per hectare. The use of ammonium sulphate at the rate of about 200 kilos per hectare on poor land as top dressing is beneficial.

In Muñoz, Nueva Ecija, the fertilizers are commonly spread over the field before the rice straw mulch is laid over. At Calaanan, Bon̄gabon, Nueva Ecija, where the soil is sandy to sandy loam the practice of green manuring has been found to be productive. After harvesting tomato, which is a secondary crop to onion, the field is planted to mungo. About 2 cavans of mungo seeds are broadcasted to a hectare. When the mungo plants are about to flower, they are plowed under and mixed thoroughly with the soil and allowed to rot for some time as green manure.

After the seedlings are already transplanted for about two weeks and have permanently set their roots into the soil, and as young and tender shoots appear to show signs of new growth, ammonium sulphate may be applied by broadcasting it directly between the rows. In the case of the direct method of planting the fertilizer is first applied when the plants are about 10–15 cm. high. At least two applications are required. The second application should follow the first, after two or three weeks' interval.

Besides ammonium sulphate, other commercial fertilizers, such as Ammo-phos (20-20), Corona de Arroz (9–9–4), etc., are also used. These fertilizers hasten and improve the vegetative growth of onion and consequently increase crop production.

Various methods of planting.—There are several methods of planting followed by different planters to suit their tastes under local conditions.

(*a*) *Single- or double-row system.*—This system of planting is done on furrows or ridges about 40–50 cm. wide for hand cultivation and from 60 to 80 cm. wide for animal cultivation. One or two rows (15–20 cm. apart) may be drawn together on a ridge. Then on the row the seedlings are set 15–20 cm. apart and 2 cm. deep. Planting too closely produces small bulbs, and cultivation and weeding become difficult. Too deep planting is objectionable as it retards bulbing or makes the bulb elongated instead of flat and rounded. If the plants produce bulbs at all when planted too deep, the bulbs are liable to rot especially in the field where the soil is retentive of excess moisture.

The furrow system of planting is commonly applicable on land without irrigation but having a shallow water table capable of supplying sufficient moisture during active growth. On land where there is irrigation the ridge system of planting is advisable.

The single-row system, leaving as it does a wide space of cultivated land vacant, naturally results in a comparatively less production per hectare. The double-row system, which is being practiced on a commercial scale at Calaanan, Bongabon, Nueva Ecija, gives very good yield under normal climatic conditions.

(*b*) *Bed system of planting.*—The bed system of planting consists of making raised beds of about 70–100 cm. wide or more depending upon the soil type. On loose and sandy soils, wider beds may be formed. The bed should be about 15 cm. above the path and the length will depend upon the desire of the planters. The bed should have from 4 to 6 rows about 15 cm. apart in the rows. The distance and depth of planting are the same as in the single-or double-row system. In places where the area is limited and where cultivation is quite intensive the plants are set closer (10–12 cm.).

The bed system of planting is applicable in small-scale production, especially in home gardens and in backyards. For large-scale production under this system, the labor involved for planting, weeding, and cultivation is quite expensive and tedious. In the provinces of Batangas and Cavite, particularly on lowlands where there are less weeds, this system of planting is very popular. On irrigated lands where rice straw may be applied as mulch, the bed system of planting may be profitable.

(*c*) *Straw-mulch system in irrigated rice land.*—The growing of onion in rotation with the early varieties of rice on land with straw-mulch and under irrigation has already been found successful in many provinces, particularly in Nueva Ecija. Bu-

lacan, and Pampanga. Under this system the land is prepared by plowing and harrowing or in case the soil is loose and loamy, plowing and harrowing are often not done. The weeds and rice stubbles are cut close to the ground and the field is thoroughly cleaned. Small ditches for irrigation and drainage purposes are dug close inside the paddies. After a week or more of exposure of the land to the sun to dry the soil, rice straw mulch of from 8 to 10 cm. thick, a quantity sufficient to check the growth of weeds and to conserve the soil moisture for a certain period of time, is spread uniformly over the cleaned paddy. The field should be thoroughly irrigated with all the excess water drained off just to moisten the soil. After about two days when the soil is ready for transplanting, that is, soft enough to allow the insertion of the tip of the finger, the seedlings are set in rows to a depth of about 1½ cm. by the use of a blunt dibble and then the soil is pressed down at the base of the plants. The plants are spaced about 15–20 cm. apart on all sides. The method of transplanting is similar to that of lowland rice except that the onion seedlings are planted singly and closer in the rows.

It requires about 80 women to transplant onion seedlings in a hectare per day in Muñoz, Nueva Ecija. About two weeks after transplanting the field is again irrigated to press down the soil completely at the base of the plants and also to keep the straw mulch sticking well into the soil. There is a risk in irrigating the field immediately after transplanting, for the water may become so excessive that the rice straw which is still loose in the soil may likely float and carry with it the newly transplanted seedlings. When the soil is almost dry, the field is generally irrigated about seven times at regular intervals. Irrigation should be controlled during the period of maturity, as it impairs the quality of the bulbs.

The straw-mulch system of planting has been found practicable in the irrigated lowland rice regions. The principal item of expense incurred by the planters under this system is the transplanting of seedlings. However, cultivation and weeding are eliminated while plowing and harrowing are optional, depending as they do upon the desire of the planters.

(*d*) *Direct method of planting.*—When the field has been thoroughly prepared, the seeds are usually drilled or sown directly in double rows (15–20 cm. apart), on ridges (40–50 cm. wide). Planting is made efficient and more economical by the use of a seeder pushed by hand.

When the young plants are about 10 cm. high, they are thinned in the rows about 7–10 cm. apart. Weeding, cultivation, irrigation, etc., are very essential in onion growth and should not be overlooked during the entire growing season.

In direct planting, the onion bulbs usually mature earlier (about one to two weeks) than when the seedlings are transplanted, and the yield per hectare is generally greater. This method of planting is advisable under clean or open culture, where the land is rolling and the growth of weeds is neither very thick nor very rapid. At present the direct planting of onion is becoming popular in Calaanan, Boñgabon, Nueva Ecija. This system of planting, however, requires more seeds per hectare, better preparation of the land, better care of the seeds while germinating or while the seedlings are still young. Small and young seedlings under exposure in the field easily succumb to the intense heat of the sun or to excessive rains.

Cultivation and weeding.—The growing of onions under open culture should be given frequent cultivation in order to place the soil in good tilth and at the same time to control the weeds effectively. The use of a moldboard plow or a five-toothed cultivator drawn by an animal along both sides of the rows is found effective. In the row between the plants, a toothed cultivator (Planet Junior Cultivator), which is pushed by hands, is also used with good results. The other implements that are ordinarily used in cultivation and weeding are garden hoe, trowel, bolo, sharp stick, rake, etc. The weeds that grow near the base of the plants may be pulled off by hand. Weeds should be removed whenever they gain a foothold. Weeding is usually done by women and children. Three or four thorough weedings until harvest time are enough.

Onion plants are shallow feeders, as the mass of their roots grows near the surface of the soil. Shallow cultivation should be done frequently and slightly toward the base of the plants so as to keep a soil mulch. In order to maintain the uninterrupted growth of the plants, it is essential that the surface soil be stirred after irrigating the field. During cultivation the bulbs should never be covered thickly, as it may induce rotting when moisture in the soil is in excess. Moreover, the bulbs produced are irregular in shape and become pale white in color. These external characteristics of onion do not find favor with the local market.

Irrigation or watering applied to land without mulch.—Water is one of the principal determining factors in producing a successful crop of onion. An abundant supply of water is necessary after transplanting, particularly during the active growth of the plants.

There are two essential factors that should be considered in irrigating an onion field, namely, (*a*) keeping the soil well supplied with moisture and (*b*) cultivating the field after irrigation as soon as the surface soil permits in order to conserve the moisture and prevent baking and cracking.

The frequency of applying irrigation water must be timed so as to produce good-quality products. Water, when applied excessively and untimely, will induce the plants to develop big-necked and soft onion bulbs.

During the entire growing season, it requires from 10 to 16 times to irrigate the field, depending upon the soil and weather conditions. In light or sandy soil, watering should be done more frequently than in heavy or clayey soil. During the cool months of November, December, and January, the field is generally irrigated at regular intervals of about two weeks, while in February, March, and April, when the weather is hot and dry, irrigation is applied after about a week or as soon as the soil becomes dry.

In irrigating the field the water must run in furrows or paths between the ridges or beds and allowed to seep into the rows or through the beds. The field should never be flooded and must be level so that the water can be applied uniformly. Any excess water that remains should be drained off immediately.

HARVESTING AND CURING

It has been the consensus of opinion among local buyers that Bermuda onions, which are locally produced, possess poor keeping quality as compared with the imported onions. This assertion is true in general, in view of the fact that most of the onion crops are harvested quite early (not matured) in order to sell at a better price in the local markets. Onions, being a perishable product, many of the planters dispose of them immediately after harvest, without giving special attention to the proper method of topping, curing, and storing.

Harvesting.—Onions are ready for harvesting when they are already matured, usually from 3 to 4 months after transplanting. The sign of maturity is the shrivelled tops or softened

necks of the bulbs. The entire crops may be harvested when about one-third of the tops are down and most of those that are standing have softened necks. Matured onions should be harvested immediately, otherwise the occurrence of rain or the presence of irrigation water may induce second growth. This is one of the reasons why irrigation should be entirely withdrawn during the period of maturity. Where there is no danger of rain, the crop can be allowed to mature thoroughly so as to improve its keeping quality.

When the onion bulbs are mature, they are pulled off gently so as not to break the dried scales of the bulbs or to cause any injury which induces decay. Then they are allowed to dry in the fields for a day or two. Care should be taken to lay the tops over the bulbs so as to prevent sunscald.

The harvested onions are then taken to the curing shed and allowed a few more days (3–6) when the tops are ready to be clipped. The best time to clip the tops is when they are completely withered. Clipping the tops, while still fresh or when the necks contain much sap, impairs their keeping quality. Topping is usually done by women, girls, and boys. The common tools used are scissors, knives, and small bolos. All topped onions are further cured before marketing.

Onions with fair-sized bulbs may also be harvested while green, as green onions can be sold in bunch, especially during market days. Local Chinese restaurants (panciterias) prefer to use green onions, because they are sweet and fresh and also because both the bulbs and the green leaves can be utilized.

Curing.—The topped onions should be laid on racks made of wire netting or bamboo slath or they may be placed on a dry straw-covered floor in the curing shed. The capacity or size of the shed should, of course, depend upon the quantity of onions to be harvested.

The principal points to be considered in building a curing shed are (1) maximum ventilation, (2) safety of the bulbs from pressure due to heaping, and (3) ease in handling the onions.

Within a week or more, depending upon the local weather conditions, the onions in the curing shed are allowed to dry off slowly and evenly and to form tough, dry, and shiny skins, or scales, which protect the bulbs. A period of dry weather during the height of the harvest season (March to April) is favorable for curing onions.

Then the uniform, clean, and sound bulbs are placed in gunny sacks or crates for the local markets or kept properly in storage. Care should be taken not to bruise the bulbs, for organisms may enter and cause decay.

A very common method of curing onions in small quantities is to tie the tops of the bulbs and then hang them under the roof of the curing shed or inside the house for at least about a week. Under this method, onions may be cured easily and thoroughly.

Bermuda onions, which are fully matured (not overmatured) and properly cured during the dry months, may be well preserved for about 3 months when kept in a dry place. The Red Globe keeps for a longer period than the Yellow Bermuda.

ONION PESTS

There are several insects which attack onions in the Philippines but those that are frequently encountered in the fields are the thrips, which cause the whitening of the tops and the production of thicknecks; and cutworms which seriously attack the leaves.

Onion thrips (*Thrips tabaci* Lind.).—They are lice-like insects which suck the onion leaves. These thrips are yellowish when young and brownish to blackish when mature. The pest is most severe during the dry season, mostly during the month of February when the crops are about to mature. The injury caused by thrips is manifested by the whitening of the tops (silver tops) as a result of the sucking of the juice in the leaves by the thrips. The thrips greatly weaken the plants, thus leading to the production of undeveloped and unmarketable bulbs known in other countries as thicknecks or scallions. In severe cases the leaves become curled or twisted and the plants finally die prematurely. When the plants partially recover, they remain dwarfed or stunted. Besides onion, the thrips may also attack other vegetables, such as cabbage, cucumber, tomato, strawberry, cauliflower, etc.

In Muñoz, Nueva Ecija, thrips usually prevail when the onion bulbs are already maturing so that not much damage is done. But in Boñgabon, Nueva Ecija, in the barrio of Lotet especially, the damage caused by thrips has been observed quite serious during the 1937–38 and 1938–39 seasons. The appearance of thrips during the early stage of the plant should be controlled immediately, otherwise the damage would be considerable.

Control.—The use of nicotine sulphate as a control measure has proved to be effective. The spray should be prepared by mixing 1 part of 40 per cent nicotine sulphate and 800 parts of water (2 spoonfuls of nicotine sulphate in a petroleum canful of water). To this mixture add 10–15 spoonfuls of powdered soap or 80-120 grams of Chinese soap (yellow) in order to give better results. A mixture of nicotine sulphate and fine starch, like "gaogao," is also good for dusting.

In the absence of nicotine sulphate, tobacco water or tobacco decoction may be used. It is prepared by soaking tobacco waste, such as tobacco stems, midribs, leaves, etc., in water until the decoction shows a strong color of tea. When used for spraying, one part of the decoction to 5–10 parts of water by volume may be used. Add from 4 to 6 grams of Chinese soap (yellow) for every liter of the diluted decoction (about ½ pound of soap to one petroleum canful of diluted decoction) will give good results.

Derris dust containing 3 per cent rotenone is quite effective against thrips. It should be dusted on the infested plants in the morning before the dew dries off. Derris powder is used as a spray at the rate of 10 to 25 spoonfuls, levelful, per petroleum canful of water. To increase the effectiveness of the spray, soap should be added at the rate of 3 to 5 grams per liter of derris spray.

Some insect killer preparations in the market, such as Imazu, Hymol, etc., are also used.

Cutworms.—Cutworms sometimes are troublesome by cutting off the plants at the surface. They hide near the plant under the clods of earth during the day. The adult moths lay eggs in grassy and weedy areas. The infestation usually occurs during the early part of the onion season when the plants are still young.

Cutworms appear in seedbeds and attack the young seedlings. The appearance of this pest in Calaanan, Bongabon, Nueva Ecija, in 1937 attracted the attention of the planters.

Control.—Crop rotation should be practiced. White arsenic, which is used as baits, mixed thoroughly with rice bran before molasses is added, should be scattered over the infested areas. The application should be done in the evening, as it is during that time that worms usually get out of their hiding places to feed. The bait should be applied immediately after its prepara-

tion, as it easily deteriorates. In the absence of rice bran, bagasse or sawdust may be substituted.

Other insects.—White grubs, onion maggots, and wireworms, which are rarely found in the fields, are only minor pests of onions although at times they may become serious pests.

DISEASES

There are many known diseases of onion in other countries but only a few of them are known and studied here, and among these the important ones are the following:

Bulb rot (*Fusarium cepae*=*Fusarium zonatum*).—The diseased plants show yellowing, followed by withering of the leaves which takes place about 5 to 10 days depending upon the severity of infection.

Before the symptoms are manifested, rotting of the bulbs starts from the stem and the growth of white molds is often found on the rotted scales. In the advanced stage of the disease, the bulbs show a semiwatery decay. They are soft and slimy to the touch. The presence of organisms, such as maggots, bacteria, and nematodes, which are frequently found in decayed tissues, hasten the rotting of the bulbs.

The fungus is spread by carrying the diseased bulbs from one place to another. The spores may be carried by surface wash during heavy rains or spread by the dust. The source of infection in the field is commonly through insect injuries in the bulb. Bruising or removing the tops down to the living tissues facilitates the attack of bulb rot disease.

Bulb rot of onion is one of the most serious diseases in certain onion fields. In Lemery, Batangas, in 1936, it was reported that from 50 to 60 per cent of the native onion was lost in the field due to rot caused by *Fusarium*. In 1935, due to the same disease, the damage for the whole province of Batangas was reported to be 24 per cent of the native onion and 2 per cent of the Bermuda onion crops.

Leaf spot (*Cercospora duddiae*).—Infected leaves of onion show various degrees of infection from slight chlorosis to death. New circular lesions (chlorotic spots), 3–5 mm. in diameter, appear mostly at the outer end of the leaves and gradually decrease in number toward the base. When the attack is older, the separate lesions give a mottled appearance. Usually in severe attacks, the entire leaf is killed and turns grayish brown.

Fruiting bodies may appear as black specks on the chlorotic tissues. The organism responsible for the leaf spot disease of onion belongs to the genus *Cercospora*. A severe leaf spot outbreak of onion had been observed in 1922 at the College of Agriculture, Los Baños, Laguna.

Other onion diseases.—The leaf blight of green onion, caused by *Macrosporium porri* Ellis, is a disease which causes complete blighting of the leaves. This has been found to be a very serious disease of onion in the Trinidad Valley, Baguio, Mt. Province. Another one is the *Sclerotium* white rot, caused by *Sclerotium rolfsii*, which has been observed in nearly all the onion fields in Batangas Province.

Control and preventive measures for different diseases attacking Bermuda onions:

(1) The seed should be disinfected and fumigated if necessary.

(2) Plant sanitation and good cultural practices, such as crop rotation, clean culture, and fertilization should be practiced.

(3) Infected plants should be removed and burned to prevent the spread of the disease.

(4) Bordeaux mixture should be sprayed or sulphur powder or copper lime dust should be dusted once a week to obtain effective results.

A. BED SYSTEM OR INTENSIVE METHOD OF PLANTING

Cost of production and yield of one hectare of Bermuda onion at Sinisian, Lemery, Batangas (1937–1938 crop), excluding land tax, depreciation and interest on investment.[1]

Item of operation	Man	Animal	Value
	Day	*Day*	
1. Seeds, 5 kilos at ₱7			₱35.00
2. Seedbed preparation and sowing, 500 sq. m., ₱1 per day	3	3	3.00
3. Care of seedlings (weeding, watering, etc.) for 40 days, ₱0.70 per day	40		28.00
4. Preparation of fields for planting:			
a. First plowing and harrowing, ₱1 per day	10	10	10.00
b. Second plowing and harrowing, ₱1 per day	5	5	5.00
c. Third plowing and harrowing, ₱1 per day	5	5	5.00
d. Forming beds, ₱0.70 per day	20		14.00
5. Transplanting, watering (bucket system) etc., ₱0.70 per day	70		49.00
6. Watering (bucket system), 6 times a week, ₱0.70 per day	160		112.00
7. Cultivation and weeding (3 times), ₱0.70 per day	120		84.00
8. Harvesting, hauling, curing, topping, sacking, etc., ₱0.70 per day	55		38.50
9. Second-hand gunny sacks, (500) at ₱0.10			50.00
10. Truck fare for 500 sacks of onion from Lemery to Manila, at ₱0.20 per sack (weighed 40 kilos, net)			100.00
Total expenses			533.50

Yield .... 500 sacks (one sack weighed 40 kilos, net).	
Gross income, at ₱2.60 per sack	₱1,300.00
Total expenses	533.50
Net income	766.50

[1] The above figures were supplied by Mr. Ambrosio M. Lontok, Provincial Agricultural Supervisor, Batangas, Batangas.

B. DOUBLE—ROW SYSTEM OF TRANSPLANTING (WITHOUT STRAW-MULCH) [a]

Cost of production and yield of one hectare of Bermuda onion at Calaanan, Bongabon, Nueva Ecija (1937–1938 crop), excluding land tax, depreciation and interest on investment.[b]

Item of operation	Man	Animal	Value
	Day	*Day*	
1. Seeds, 3 kilos at ₱7.00			₱21.00
2. Seedbed preparation, area —450 sq. m.			
a. Plowing and harrowing (6 times), ₱1.50 per day	3	3	4.50
b. Forming beds, etc., ₱0.80 per (man) day and ₱1 per (animal) day	5	½	4.50
c. Sowing of seeds, watering, etc., ₱0.80 per day	8		6.40
3. Care of seedbeds for 60 days, ₱0.80 per day	60		48.00
4. Preparation of the fields:			
a. First plowing and harrowing, ₱1.50 per day	7	7	10.50
b. Second plowing and harrowing, ₱1.50 per day	6	6	9.00
c. Third plowing and harrowing, ₱1.50 per day	6	6	9.00
d. Forming ridges, ₱1.50 per day	5	5	7.50
5. Mungo for green manuring:			
a. Seeds, 2 cavans at ₱9			18.00
b. Plowing the fields for sowing mungo, ₱1.50 per day	5	5	7.50
c. Broadcasting the mungo, ₱0.80 per day	1		0.80
d. Plowing under and mixing with the soil, ₱1.50 per day	2	2	3.00
6. Application of fertilizer:			
a. Ammonium sulphate, 4 sacks (200 kilos, net weight) at ₱5.20 per sack			20.80
b. Applying the fertilizer over the fields, ₱0.80 per day	2		1.60
7. Transplanting including lifting, watering, etc., ₱0.40 per day	[1] 60		24.00
8. Irrigation (16 times), ₱0.80 per day	32		25.60
9. Cultivation between ridges, ₱1.50 per day	10	10	15.00
10. Cultivation between rows of plants, ₱0.80 per day	10		8.00
11. Weeding (3 times), ₱0.40 per day	[1] 125		50.00
12. Harvesting, ₱0.80 per day	9		7.20
13. Drying, hauling, etc., ₱1.50 per day	4	4	6.00
14. Clipping and transporting to curing shed, ₱0.40 per day	[1] 35		14.00
15. Curing, sacking, etc., ₱0.80 per day	15		12.00
16. Gunny sacks, free (supplied by buyers)			
Total expenses			333.90

[1] Woman day.

Yield 350 sacks (one sack 40 kilos net).	
Gross income, at ₱3.00 per sack	₱1,050.00
Total expenses	333.90
Net income	716.10

[a] Average of five farm units.

[b] The above figures were supplied by Mr. Jose C. Ramos, provincial agricultural supervisor of Nueva Ecija.

C. STRAW—MULCH SYSTEM IN IRRIGATED RICE LAND [a]

Cost of production and yield of one hectare of Bermuda onion at Bagong-sikat, Muñoz, Nueva Ecija (1937–1938 crop), excluding land tax, depreciation and interest on investment.[b]

Item of operation	Man	Animal	Value
	Day	*Day*	
1. Seeds, 3 kilos at ₱7	--------	--------	₱21.00
2. Seedbed preparation, area—450 sq. m.:			
a. Plowing and harrowing (3 times), ₱1.80 per day	3	3	5.40
b. Forming beds, etc., ₱0.80 per day	8	--------	6.40
c. Sowing of seeds, watering, etc., ₱0.80 per day	2	--------	1.60
3. Care of seedbeds, such as weeding, watering, fertilizing, etc., for 60 days, ₱0.80 per day	60	--------	48.00
4. Fertilizers for seedlings, 8 kilos (Corona de Arroz) at ₱0.11	--------	--------	0.88
5. Field preparation, such as cutting grass and rice stubbles, weeding, mulching, digging canals in the paddies, etc., ₱1 per day	40	--------	40.00
6. Transplanting, lifting of seedlings, etc., ₱0.40 per day	[1] 80	--------	32.00
7. Application of fertilizers, 3 sacks (150 kilos, net weight) of Corona de Arroz at ₱5.50	--------	--------	16.50
8. Broadcasting the fertilizer, ₱0.80 per day	2	--------	1.60
9. Irrigation (7 times), ₱0.80 per day	8	--------	6.40
10. Harvesting:			
a. Pulling, drying, cutting, etc., ₱0.40 per day	[1] 100	--------	40.00
b. Hauling from fields to curing shed, ₱1 per day	6	6	6.00
11. Curing, sacking, etc., ₱0.80 per day	12	--------	9.60
12. Cost of 300 second-hand gunny sacks at ₱0.10	--------	--------	30.00
Total expenses	--------	--------	265.38

[1] Woman day.

Yield	300 sacks (one sack weighed 40 kilos, net.)	
Gross income, at ₱2.50 per sack		₱750.00
Total expenses		265.38
Net income		484.62

[a] Average of at least five farm units.

[b] The above figures were supplied by Mr. Jose C. Ramos, Provincial Agricultural Supervisor of Nueva Ecija.

D. SEED OR DIRECT METHOD OF PLANTING [a]

Cost of production and yield of one hectare of Bermuda onion at Calaanan, Boñgabon, Nueva Ecija (1937–1938 crop), excluding land tax, depreciation and interest on investment.[b]

Item of operation	Man	Animal	Value
	Day	*Day*	
1. Seeds, 4 kilos at ₱7	--------	--------	₱28.00
2. Field preparation:			
a. First plowing and harrowing, ₱1.50 per day	12	12	18.00
b. Second plowing and harrowing, ₱1.50 per day	10	10	15.00
c. Third plowing and harrowing, ₱1.50 per day	10	10	15.00
3. Mungo as green manure:			
a Seeds, 2 cavans at ₱9	--------	--------	18.00
b. Plowing the fields, ₱1.50 per day	5	5	7.50
c. Broadcasting the mungo seeds, ₱0.80 per day	1	--------	0.80
d. Plowing under and mixing with soil, ₱1.50 per day	2	2	3.00
4. Application of fertilizer:			
a. Ammonium sulphate, 4 sacks (one sack weighed 50 kilos, net) at ₱5.20	--------	--------	20.80
b. Applying the fertilizer to the fields, ₱0.80 per day	2	--------	1.60
5. Drilling the seeds by using the seeder and than irrigating the fields, ₱0.80 per day	5	--------	4.00
6. Thinning the rows, etc., ₱0.40 per day	[1] 20	--------	8.00
7. Irrigation (16 times), ₱0.80 per day	32	--------	25.60
8. Weeding (5 times), ₱0.40 per day	[1] 300	--------	120.00
9. Cultivation (25 times), ₱1.50 per day	75	75	112.50
10. Harvesting, topping, curing, sacking, etc., ₱0.40 per day	[1] 106	--------	42.40
11. Gunny sacks, free of charge (supplied by buyers)	--------	--------	----------
Total expenses	--------	--------	440.20

[1] Woman day.

Yield .... 475 sacks (one sack weighed 40 kilos, net.)	
Gross income, at ₱3.00 per sack	₱1,425.00
Total expenses	440.20
Net income	984.80

[a] Average of at least five farm units.

[b] The above figures were supplied by Mr. Jose C. Ramos, provincial agricultural supervisor of Nueva Ecija.

Table A.—More seeds were used than what were required, because the seedlings from the seeds that were planted first in seedbeds were greatly damaged by the typhoon of November 17, 1937. For this reason, an additional quantity of seeds was again planted immediately. Watering from well by means of a bucket is laborious and therefore very expensive. Another big expense incurred by the planters is the truck fare (total ₱100) in transporting the 500 sacks of onion from Lemery to Manila. Cultivation and weeding were done exclusively by hand. Most of the onions harvested were of poor quality because of the heavy rains in April, 1938, which caused the reduction of price of onions in Manila markets.

Table B.—A better price was obtained per sack (40 kilos net weight), because most of the onions were harvested early and possessed better quality. There was no expense in transporting the products to the market, because the buyers purchased them direct from the farm.

Table C.—Transplanting of seedlings was quite slow and more expensive because of the rice straw-mulch which was used to cover the soil. However, cultivation and weeding were both eliminated. More labor was spent in harvesting the crop, because the onion bulbs did not mature at the same time so that from 3 to 5 harvests were done in one lot. The price per sack of onions (40 kilos net weight) was also reduced, because the quality was impaired due to improper curing.

Table D.—In the direct method of planting, weeding and cultivation incurred a big expense. Frequent cultivation and weeding were done to put the soil in good tilth and to check the rapid growth of weeds. Weeding was done mostly by hand. Most of the onions were produced early, and they possessed better quality. These were sold at a good price. There was no expense for transporting the products to the market, because the onions were purchased direct from the farms.

In all the cases mentioned above, the project was administered by an experienced Bermuda onion planter. Because of the favorable weather conditions which prevailed during the growing season of onion immediately after the typhoon of November, 1937, fairly good harvests were obtained.

MARKETING

Bermuda onion has already a local market in the Philippines, as this country imports more than half a million pesos every year.

In marketing Bermuda onion in the Philippines, the following important conditions should be considered:

(1) Early crop.

(2) Properly matured and cured crop.

(3) Properly cleaned and graded crop.

(4) Properly packed crop in attractive containers of standard size.

(5) Locating sufficient buyers before harvesting.

(6) Organizing coöperative marketing associations.

(1) *Early crop.*—Bermuda onions planted during the early part of October and harvested during the month of February were found to sell at a higher price than those harvested during the regular harvest season (March–May). This is probably due to the great demand and limited supply of onions in the local markets in February.

During the past three years, in Calaanan, Boñgabon, Nueva Ecija, where early crops were raised, one sack (40 kilos net weight) was sold from ₱4.00 to ₱4.80. During the regular harvest season, the price of same varies from ₱2.40 to ₱3.20 a sack direct on the farm.

(2) *Properly matured and cured crop.*—Bermuda onions which are harvested when fully matured and then properly cured under the curing shed possess good quality and therefore command a better price per kilo. The best quality of Bermuda onion produced thus far came from Calaanan, Boñgabon. Generally the onions from this place are sold in the Manila markets at ₱.50 higher per sack (40 kilos net weight) than those from Lemery, Batangas, and Muñoz, Nueva Ecija, where little or no curing at all is done at present.

In the Philippines, Nos. 3 and 4 as above mentioned were not given serious attention so far, so that the native Bermuda onion is not attractive to the buyers. These buyers severely criticize our native Bermuda onions in the local markets, because, besides the fact that they do not look nice and are difficult to handle, they are of poor quality. Crates of standard size are much preferred by the local buyers. When crates are used, they are handy and the percentage of damage during transit is greatly minimized.

(5) *Locating sufficient buyers.*—The onion importers or wholesale dealers prefer to buy the imported onions so that it is safe for the local growers to locate buyers before the harvest season in order to sell their crops at a fairly good price. In Manila, for instance, there are at present 24 important local importers

of onions from foreign countries and 6 big local dealers that buy native Bermuda onion in big quantities.

During the 1938 and 1939 harvest seasons, the onions harvested at Calaanan, Bongabon, were mostly contracted by the local dealers so that the planters did not find any difficulty in marketing their onions, and at the same time they sold them at a reasonable price.

The disadvantage of taking with them to Manila truckloads of onions placed in sacks without definite buyers has been experienced by some onion planters, especially in Muñoz, Nueva Ecija. This method of marketing resulted in sales at lower prices per sack than would have been obtainable on the farm.

(6) *Organizing a coöperative marketing association.*—A coöperative marketing association is very essential among onion growers. This association will help them greatly in marketing their crops. It will maintain the price and will protect them from the unscrupulous middlemen or buyers who monopolize the market and dictate their own prices.

The coöperative marketing association, which was organized in Muñoz, Nueva Ecija, in March, 1937 helped greatly in stabilizing the local price of onions from ₱0.08 to ₱0.10 per kilo during the entire harvest season of 1937. During the 1936 harvest season, when there was no association of such kind, the price of onion in the locality was about ₱0.06 per kilo. At present this association is inactive and needs local support.

USES

Bermuda onion is very common as a part of the food of the people, especially in many of the culinary preparations. Onions are mixed with other vegetables and made into pickles which keep for a long time. Green onions are cooked as vegetables for food.

PROBLEMS OF THE INDUSTRY

The industry of growing Bermuda onion, being new in the Philippines, is confronted with several problems and among those which deserve our careful attention are the following:

(1) *On seeds.*—Our annual importation of fresh seeds of desirable varieties must arrive in the Philippines early in September to allow early planting in places where it is suitable. Experience has shown that late planting of Bermuda onion in many provinces oftentimes failed.

(2) *On locally produced seeds.*—So far the onion seeds for planting are imported from abroad and in view of this fact, it is very necessary that the Philippines should produce its own seeds in order (*a*) to do away with importation, thus reducing the cost of production, (*b*) to facilitate the proper and even distribution of the seeds among the planters, and (*c*) to encourage studies of this crop.

(3) *On culture.*—The problems of preparing seedbeds and care of seedlings, preparation of the fields for transplanting, weeding and irrigating the fields, and harvesting are yet to be worked out to make the procedure of growing onion more effective and economical.

(4) *On curing.*—Proper curing should be undertaken in order to raise better quality of onions which will keep in storage for about 3 to 4 months so as to prevent the necessary dumping of the same in the local markets, especially during the harvesting season and also to impress upon the local buyers the fact that our native Bermuda onion compares favorably in quality and taste with the imported onions.

(5) *On pests and diseases.*—Pests and diseases have been the worst enemies and, therefore, the planters must be thoroughly equipped with knowledge of, and provided with equipment and chemicals in, controlling them effectively.

(6) *On marketing.*—There must be a systematic marketing of the native Bermuda onion in order to insure a ready market. Coöperative marketing associations among onion producers are very imperative and very timely at present.

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ILLUSTRATIONS

PLATE 1

FIG. 1. Weeding 2½-month-old Yellow Bermuda onion planted directly in double rows.

2. A three-month-old Yellow Bermuda onion after it was transplanted in the rice paddies with rice-straw mulch.

PLATE 2

FIG. 1. Spraying Yellow Bermuda onion plantings which are slightly affected by thrips.

2. Yellow Bermuda onion plantation seriously infested with thrips.

PLATE 3

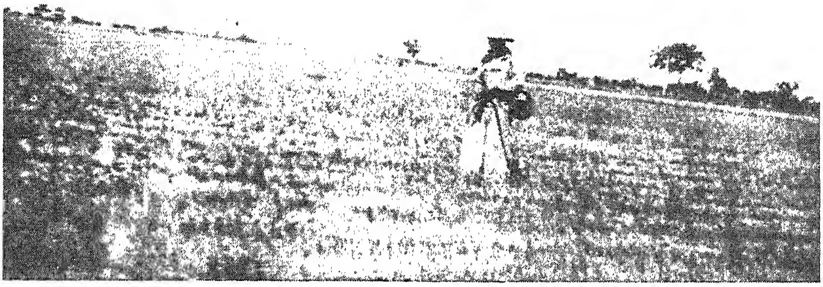
FIG. 1. Harvesting Yellow Bermuda onion crop.

2. Topping onion bulbs. The background is an ordinary curing shed.

1

2

PLATE 1.



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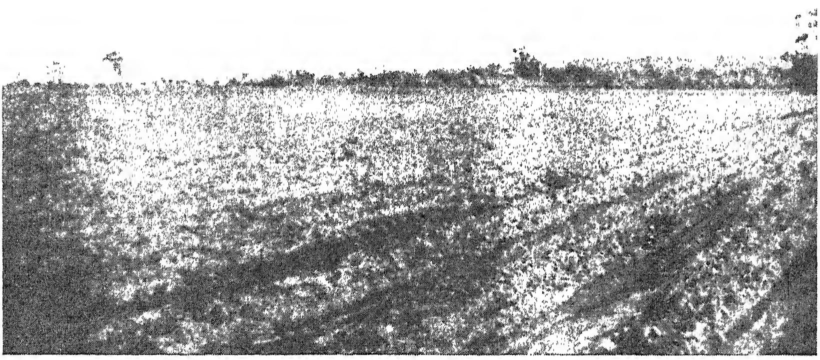

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PLATE 2.

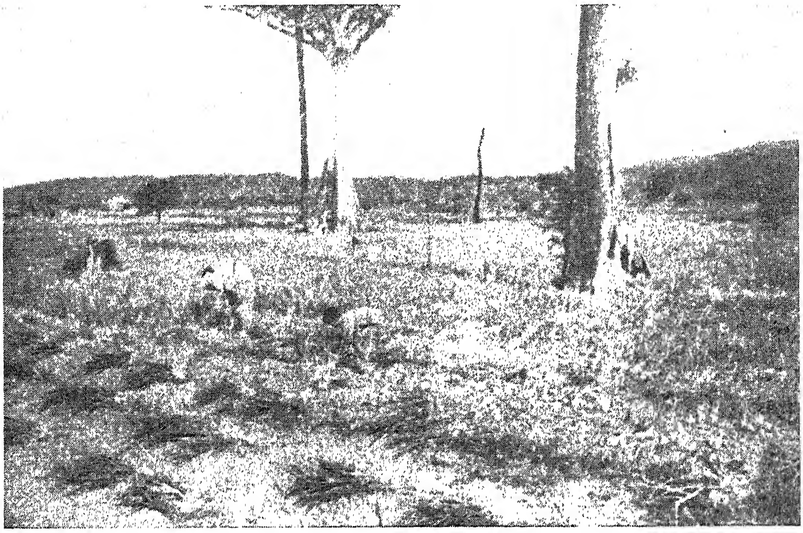

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PLATE 3.

CORRECTION

Plagiodera metallica Er., an article on the biology of which was published in the Philippine Journal of Agriculture, Vol. 10, No. 4, pp. 415 to 417, really belongs to the family Chrysomellidae and not to the Coccinellidae as was published. The attention of the author of the article, Mr. Salustiano S. Gonzales, was called to this fact by Dr. Fritz van Emden, of the Imperial Institute of Entomology, London, England, who stated that it was only by some mistake that the species was originally described as a lady beetle of the genus *Coccinella*. Dr. van Emden also stated that the identification of the species was made by Mr. G. E. Bryant of the same institution, which fact was mentioned in Dr. Emden's letter of January 10, 1939 to Mr. Gonzales.

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NOTES ON THE ORIENTAL MIGRATORY LOCUST (*LOCUSTA MIGRATORIA MANILENSIS* MEYEN) WITH SPECIAL REFERENCE TO ITS SOLITARY PHASE AND BREEDING PLACE OR OUTBREAK AREA[1]

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FOUR PLATES

In 1927, the writer called attention to Uvarov's phase theory, propounded by him in 1921, and pointed out its practical application to the control of the migratory locust in the Philippines. Since then several papers by local authors (Gonzales, 1932; Otanes, 1931 and 1939; Goseco, 1933; and Uichanco and Gines, 1937) have appeared from time to time in which they make use of the phase theory in connection with their data or observations. In other countries, among the investigators whose works have thrown much light on the phase theory, besides Uvarov, are Faure (1932) of South Africa, Zolotarevsky (1929) of Madagascar and Johnston (1926) of Sudan. According to this theory, all migratory locusts have three main phases in their development, namely, *solitaria, transiens* and *gregaria* or *migratoria,* which differ more or less in appearance and habits. The phase *transiens* has been subdivided by Uvarov and Zolotarevsky (1929) into two, namely, *congregans* and *dissocians.* During periods when migratory swarms are not found, the species concerned exists as solitary insects which are practically harmless and live and behave like ordinary grasshoppers. When certain conditions obtain or as a response to certain un-

[1] Received for publication September 9, 1940.

usual conditions in the environment (Uichanco and Gines, 1937) these solitary forms multiply, the offspring forming loose swarms (phase *transiens*, subphase *congregans*) and eventually the greatly increased progeny become migratory both in appearance and habits. The scattered swarms of these combine or coalesce and the denser the numbers of the insects become the greater is the migratory impulse of the insects and migration then takes place resulting in the invasion of the populated and cultivated areas. When the swarms are greatly thinned out by natural factors and human efforts, the small swarms that are left break up and produce progeny of the phase *transiens* (subphase *dissocians*) and the development later culminates in the production of individuals of the solitary phase. The solitary individual insects may be considered then as the parents, as it were, of migratory swarms, the components of which differ markedly from the solitary individuals in certain respects, such as color, shape and size of certain parts of the body, etc., so that they have been formerly identified as distinct species. According to Uvarov (1936), the solitary phase is the normal state of the species which insures its perpetuation, while the gregarious or migratory phase arises as an inevitable physiological response of the species to unusual or violent fluctuations in the vital environmental factors, such as temperature, humidity, etc. In other words, the migratory phase is only temporary. Conditions in the breeding or outbreak areas of the species may so undergo such marked changes that migratory swarms are no longer developed but the species will continue to exist because of its solitary phase. The phase theory, then, as shown by the results of extensive investigations in other countries and to a certain extent in the Philippines, appears to explain in a satisfactory manner the appearance and disappearance and fluctuations of locust outbreaks.

FACTORS INFLUENCING AGGREGATION AND THE FORMATION OF MIGRATORY SWARMS

The factors that influence the breeding of the solitary forms of migratory locusts to swarms of the phase *transiens* and then these eventually to swarms of the phase *gregaria* or *migratoria* are believed to be chiefly climatic. Unusually prolonged droughts, for instance, which occur at long irregular intervals, are most commonly associated with the occurrence of swarm invasions or locust outbreaks. Available evidence tends to show

that locusts are highly sensitive to high temperature and low humidity and these conditions obtain for extended periods during droughts. It is believed that during such droughts the solitary forms of a migratory locust tend to congregate in restricted areas where the grass is green, such as in depressions, pockets or small valleys and along river and creek beds, etc., and their coming together stimulates breeding, and perhaps partly because of the relative scarcity of natural checks, such as parasites, these being believed to be more greatly adversely affected by droughts than the locusts themselves, the latter go on multiplying at an accelerated rate. The scattered swarms formed, as has been stated, tend to combine or coalesce and the denser the insects become, the greater the mating and the swarming instincts become, leading to the formation of migratory swarms, which leave the breeding or outbreak areas to invade cultivated and populated areas. The outbreak may persist for several or many years, reaching its peak at a certain year, and then begins to wane until no more migratory swarms are found.

In the Philippines, outbreaks of the Oriental Migratory Locust (*Locusta migratoria manilensis* Meyen) occur at irregular intervals, 7 to 13 years (the average being 10 to 11 years), according to the records of the old Bureau of Agriculture and the Bureau of Plant Industry since 1912 and the interval between outbreaks is one to two years. Thus, on July 28, 1917, it was reported by Hernandez (1919) that no known locust swarms existed in the Philippines. However, in 1918 slight infestations were reported, but it was not until 1919 when larger swarms, especially in Mindanao and Sulu, were reported. This 1919 outbreak gradually increased and reached its peak in 1922, when the number of municipalities infested increased from 60 to over 380. Since then, the infestation gradually decreased, and in 1929 the Philippines was officially declared free of locust. In 1930, slight infestations occurred in Davao, Mindoro, and Occidental Negros, but as was reported by Otanes (1931), the insects were not of the migratory phase but of the phase *transiens*. During 1931, more infestations of the phase *transiens* were reported but it was not until January, 1932 when dense migratory swarms appeared in Cotabato and by May, 1932 swarms had invaded not only other provinces in Mindanao but also Cebu, Bohol, Leyte, Negros, Panay, Samar, Masbate, etc. By June, 1939, the 1932 outbreak had come to an end, as no

more migratory swarm could be found. At this writing (July, 1940), slight infestations of the phase *transiens* have been reported from Cagayan, Mindoro, Isabela, and Occidental Negros. Basing upon the records and upon the appearance of these widely occurring infestations of the phase *transiens*, a new outbreak of migratory swarms may occur again between 1941 and 1943 (that is 10 to 11 years from 1932) or not very far beyond 1943.

THE SOLITARY AND OTHER PHASES OF THE ORIENTAL MIGRATORY LOCUST

In the Philippines, the phase *gregaria* of the Oriental Migratory Locust (*Locusta migratoria manilensis* Meyen) appears to have been well characterized biometrically by Uichanco and Gines (1937). Data, however, on the phase *solitaria* of this oriental species are lacking. In view of this, the writer deemed it timely to publish the following notes on the solitary phase of the Oriental Migratory Locust, preliminary to a more detailed paper on the studies that have been made further on the biology and control of said species.

In 1931, specimens of solitary locusts were collected from Cebu. Several of these were sent to Doctor B. P. Uvarov of the Imperial Bureau of Entomology, London, England, with the statement that similar specimens in the collection of the Bureau of Plant Industry were labeled as *Locusta australis* Saussure, which is regarded by him (Uvarov, 1928) as a phase of *Locusta migratoria*. Doctor Uvarov identified the specimens sent him as of the phase *solitaria* of the local migratory locust, then still known as *Locusta migratoria migratorioides* R. & F., now *Locusta migratoria manilensis* Meyen (Uvarov, 1936), with the remarks that the specimens showed some characters of transition to the swarming phase (phase *gregaria*).

In order to more definitely ascertain the characteristics of the locust collected from Cebu, in terms of ratios of the measurements of certain body parts, the remaining specimens, consisting of 7 males and 5 females, were measured. These measurements, as shown in table 1, gave as average ratios for the females 1.86 for E/F (ratio of tegmen or "elytron" to femur); 1.35 for P/C (pronotum to width of head); 1.26 for H/C (height of pronotum to width of head) and 0.92 for M/C (width of pronotum to width of head). The corresponding measurements for the males are 1.74 for E/F; 1.48 for P/C; 1.37 for H/C and 0.93 for M/C. The measurements were made in ac-

TABLE 1.—*Measurements of locusts*[1] *collected from a loose swarm in Cebu, October 15, 1931.*

Number	Sex	E	F	P	H	M	C	E/F	P/C	H/C	M/C
1	F	4.89	2.70	0.95	0.91	0.60	0.69	1.81	1.38	1.32	0.87
2	F	4.50	2.44	0.86	0.85	0.61	0.65	1.84	1.32	1.31	0.94
3	F	4.51	2.43	0.90	0.86	0.62	0.65	1.86	1.38	1.32	0.95
4	F	4.30	2.35	0.84	0.80	0.58	0.63	1.83	1.33	1.27	0.92
5	F	4.03	2.05	0.82	0.74	0.56	0.61	1.97	1.34	1.21	0.92
Totals		22.23	11.97	4.37	4.16	2.97	3.23				
Average ratios								1.86	1.35	1.26	0.92
1	M	3.40	2.00	0.75	0.70	0.46	0.48	1.70	1.56	1.46	0.96
2	M	3.47	1.98	0.76	0.66	0.47	0.50	1.75	1.52	1.32	0.94
3	M	3.90	2.20	0.80	0.73	0.51	0.56	1.77	1.43	1.30	0.91
4	M	3.57	1.94	0.73	0.68	0.48	0.52	1.84	1.40	1.31	0.92
5	M	3.23	1.88	0.69	0.69	0.43	0.49	1.73	1.41	1.41	0.88
6	M	3.25	1.90	0.74	0.70	0.45	0.48	1.71	1.54	1.46	0.94
7	M	3.36	1.96	0.72	0.65	0.46	0.48	1.72	1.50	1.35	0.96
Totals		24.18	13.86	5.19	4.81	3.26	3.51				
Average ratios								1.74	1.48	1.37	0.93

[1] Collected by A. G. Toquero of the Plant Pest and Disease Control Division, Bureau of Plant Industry, Manila.

cordance with the suggestions in the Proceedings of the Fourth International Locust Conference held at Cairo, Egypt, in April, 1936. For the benefit of local workers and fieldmen engaged in locust control work, who have no access to the Proceedings just referred to, the writer has reproduced the figure (plate I) showing the methods of measurement adopted. The average ratios were likewise figured in accordance with the suggestions in said Proceedings, namely, that the average ratios be obtained by calculating the ratios of the totals and not the average of the individual ratios.

With a pair of dividers and a ruler, preferably one that is calibrated to 0.5 millimeter, one may, by following the methods suggested here, ascertain definitely the phase characters of any adult locust specimens or of a given swarm by measuring specimens caught from such swarm and computing the average ratios of the different measurements so made and comparing them with the average ratios given in this paper for the different phases of the Oriental Migratory Locust. The value to fieldmen engaged in locust scouting and control of an up-to-date knowledge of the biology of the migratory locust, especially as regards its phases in the light of the results of studies here and abroad, cannot be overemphasized. Their ability to differentiate the phases in the field will add greatly to the accuracy of their reports and will thus help more effectively in the study of the biol-

ogy and ecology of the migratory locust, the results of which serve as a basis for a more intelligent warfare against the pest.

Uvarov's measurements (1936) of two specimens, one male and one female, collected from Nanking, China, together with average ratios from specimens of the phase *transiens*, are as follows:

	E/F	P/C	H/C	M/C
Phase *solitaria*				
Male	1.87	1.33	1.25	0.91
Female	1.92	1.53	1.31	0.92
Phase *transiens*				
Average for all specimens				
Male	1.83	1.25	1.19	0.86
Female	1.91	1.25	1.20	0.88
Average for Los Baños specimens				
Male	1.88	1.26	1.20	0.89
Female	1.92	1.22	1.20	0.89

Although Doctor Uvarov's measurements are based on a very limited number of specimens as he himself (1936) bewailed, yet they are the only data available for our species for the purposes of this paper. As stated, his figures for the phase *solitaria* were taken only from one male and one female collected from Nanking, China, in 1932. The phase *transiens* was better represented, specimens bred in cages in Los Baños, Laguna, sent by Doctor L. B. Uichanco, of the College of Agriculture, University of the Philippines, being among those studied by Doctor Uvarov. Other specimens of the phase *transiens* were from Nanking, China, Indo-China, Malaya, and Borneo. As to the phase *gregaria* Uvarov's likewise apparently limited number of specimens came from Nanking, China, and North Celebes. There was none from the Philippines. However, it may be stated in this connection that extensive biometrical measurements have been made by Uichanco and Gines and their results are presented in their recent paper (1937). These measurements were taken from numerous specimens most of which were collected by fieldmen of the Bureau of Plant Industry. These were collected from more or less dense swarms so that apparently they were chiefly of the phase *gregaria* or *migratoria* and the remarkably close agreement of the mean ratios obtained by Doctor Uichanco and Mr. Gines and those of Doctor Uvarov's data tend to confirm this statement. It may be said, therefore, that biometrically, the phase *gregaria* has been well characterized by the data obtained by these two authors. For the benefit

of local workers and for purposes of reference their mean ratios and those of Doctor Uvarov are given hereunder:

	E/F	P/C	H/C	M/C
Uvarov's data				
For phase *gregaria*				
Male	2.11	1.11	1.10	0.81
Female	2.16	1.11	1.08	0.83
Uichanco and Gines' data				
Male	2.14	1.10	1.01	
Female	2.20	1.09	1.01	

It may be noted from these measurements that the differences in the average E/F ratios (for all specimens) in the phases *transiens* and *solitaria* are not significant, the more so in the case of the average E/F ratio of the Los Baños *transiens* specimens. It is only in the ratios P/C, H/C and M/C that more or less significant differences obtain.

Comparing our average ratios for the Cebu lot with Doctor Uvarov's figures, the E/F ratios are nearer those of the phase *transiens*—especially so in the case of the female. However, as stated, the differences in the E/F ratios in both phases are not significant. The female also seems to be nearer the phase *transiens* with respect to the P/C ratio. But in the other ratios, P/C, H/C and M/C, the male specimens of the Cebu lot are predominantly *solitaria* in character, thus confirming the identification of Doctor Uvarov that the specimens from Cebu sent to him for study were of the phase *solitaria,* but showing characters of transition to the swarming phase, especially so in the case of the females. The males, however, are distinctly *solitaria* in character.

BREEDING PLACE OR OUTBREAK CENTER

These specimens from Cebu were collected in 1931 from a loose or thin swarm in a cultivated field—that is before the 1932 outbreak, which lasted until June, 1939. This outbreak, so far as the records of the Bureau of Plant Industry show, started in Cotabato, Mindanao. The accompanying map (plate 4) shows the general movement of locust swarms during the 1932–1939 outbreak, as based on field observations and on the reports of the fieldmen of the Bureau of Plant Industry and provincial and municipal officials. The shaded area indicates the probable outbreak areas of the Oriental Migratory Locust. Swarms reached only as far as the Provinces of Laguna and Batangas. The more extensive campaigns conducted may chiefly account

TABLE 2.—*Measurements of solitary locust specimens collected from different places and bred in the Entomology Laboratory at Singalong, Manila.*

(Most of the specimens were collected by A. G. Toquero)

No.	Place collected	Date	Sex	Measurements in centimeter						Ratios				Remarks
				E	F	P	H	M	C	E/F	P/C	H/C	M/C	
1	Lubao, Pampanga	Aug. 17, 1935	F	------	------	0.94	0.90	0.62	0.68	------	1.38	1.32	0.91	Brown. Femora missing.
2	Singalong, Manila	Sept. 9, 1935	F	4.85	2.90	1.05	1.00	0.65	0.72	1.67	1.46	1.39	0.90	Green. Caught in copula with male No. 1.
3	Singalong, Manila	March 19, 1936	F	4.85	2.78	0.98	0.96	0.65	0.70	1.74	1.40	1.37	0.93	Green.
4	Singalong, Manila	Aug. 25, 1937	F	4.95	2.81	1.02	0.95	0.65	0.70	1.76	1.46	1.36	0.93	Brown. Mated with male No, 2.
5	Bangued, Abra	Sept. 13, 1937	F	4.86	2.73	1.01	0.94	0.65	0.68	1.78	1.49	1.38	0.96	Green. Mated with male No. 3.
6	Bangued, Abra	Sept. 14, 1937	F	4.78	2.79	1.02	0.95	0.63	0.70	1.71	1.46	1.36	0.90	Brown. Mated with male No. 4.
7	Bangued, Abra	Sept. 20, 1937	F	4.92	2.82	1.00	0.95	0.66	0.72	1.75	1.39	1.32	0.92	Green. Mated with male No. 5.
8	Candon, Ilocos Sur	Sept. 22, 1937	F	4.90	2.82	1.02	0.92	0.66	0.69	1.74	1.48	1.33	0.96	Brown. Mated with male No. 6.
Totals				34.11	19.65	8.04	7.57	5.17	5.59					
Average ratios										1.74	1.44	1.35	0.92	

1	Singalong, Manila	Sept. 9, 1935	M	3.80	2.20	0.75	0.70	0.48	0.50	1.73	1.50	1.40	0.96	Green. Caught in copula with female No. 2
2	Singalong, Manila	Aug. 25, 1937	M	3.41	2.02	0.76	0.66	0.49	0.52	1.69	1.46	1.27	0.94	Green. Mated with female No. 4.
3	Bangued, Abra	Sept. 13, 1937	M	3.45	2.02	0.76	0.69	0.45	0.52	1.71	1.46	1.33	0.87	Green. Mated with female No. 5.
4	Bangued, Abra	Sept. 14, 1937	M	3.32	1.86	0.70	0.63	0.42	0.45	1.78	1.56	1.40	0.93	Brown. Put with female No. 6 in a breeding jar to mate.
5	Bangued, Abra	Sept. 20, 1937	M	3.52	2.04	0.75	0.65	0.45	0.52	1.73	1.44	1.25	0.87	Green.. Mated with female No. 7.
6	Candon, Ilocos Sur	Sept. 22, 1937	M	3.62	2.05	0.75	0.68	0.47	0.51	1.77	1.47	1.33	0.92	Brown. Mated with female No. 8.
Totals				21.12	12.19	4.47	4.01	2.76	3.02					
Average ratios										1.73	1.48	1.33	0.91	

for the fact that the greater part of Luzon had not been infested. Records also show that the preceding outbreak (the 1919 outbreak) likewise started in Cotabato, Mindanao (Merino, 1919). Available evidence, therefore, tends to indicate that the main breeding ground or outbreak center of the Oriental Migratory Locust is found somewhere in the grassland areas of Cotabato—most likely in Central and Southern Cotabato, where the soil is generally sandy and where the climate is characterized by prolonged dryness. The known outbreak centers of other species of migratory locusts in other countries are known to possess similar characteristics. Loose or thin swarms, like that in Cebu, were likewise observed in other provinces such as Mindoro, Occidental Negros, Cotabato, Batangas, and Tarlac, and on the basis of these widely separated sporadic loose swarms, the writer ventured the statement that these might be indications or tell-tale signs of a forthcoming outbreak. And truly enough, the 1932 outbreak, which appeared to have started in Cotabato, came soon thereafter.

The small widely scattered infestations reported in 1918 (Merino) from Bukidnon, Nueva Ecija, Pangasinan, Davao, Sorsogon, and Cotabato, that is before the 1919 outbreak, appeared to have been like those reported in 1931, that is, they were thin swarms consisting of heterogenous individual insects belonging to the phase *transiens*, judging from specimens collected under the old Bureau of Agriculture. The occurrence of such sporadic slight infestations of the phase *transiens* appears to be a practical basis for predicting the appearance of an outbreak and as a guide as to when extensive scouting work may be started with the object of controlling swarms of the phase *transiens* in order to prevent an outbreak. Such infestations were easily stamped out by general campaigners under Locust Act No. 2472, with the exception of those in Cotabato, where the sparsity of population and lack of transportation facilities militated against effective locust control work. In 1919, Cotabato and Bukidnon remained infested and swarms coming from these provinces, especially from the former, infested other provinces in Mindanao and the Visayas. In 1922, migratory swarms had infested Luzon, as well as Mindanao and the Visayas.

That Cotabato is the most probable chief breeding or outbreak center of the Oriental Migratory Locust has been known for a long time by inhabitants in Mindanao and this is supported by records of the movements of swarms of the old Bureau of Agriculture and its successor, the Bureau of Plant Industry.

The outbreak area in which swarms breed that later will invade large areas (invasion areas) is not necessarily a large one. Thus the known outbreak area of the African Migratory Locust (*Locusta migratoria migratorioides* Reiche and Fairmaire) consists of only about 7,200 square miles (1936), yet from this area there arose and gradually spread the swarms which overran territories in Africa comprising, at the lowest computation, from 8 to 10 million square miles. Based on this ratio, an outbreak area or areas of about 92 square miles is sufficient to give rise to swarms capable of overrunning the Philippines with a total area of about 115,000 square miles. Cotabato has an area of over 9,000 square miles, so that there is no doubt that Cotabato has enough space for the breeding of locusts to such amounts as may be sufficient to overrun the entire Philippines.

It may be pointed out here that there is also the possibility of swarms flying into the Philippines from Borneo by way of the Sulu Archipelago or Celebes and Cotabato in the same way that swarms from Northern Luzon invaded Formosa, as has been reported by certain Japanese investigators (Uichanco, 1936). Borneo is a large island, relatively speaking, and it is one of the other places known where the Oriental Migratory Locust exists. Besides the fact that specimens of the solitary phase have been collected from Borneo (Uvarov, 1936), it is interesting to note from Doctor Uvarov's report that there were invasions in Borneo before outbreaks occurred in the Philippines. Thus they had an invasion in Borneo in 1918, that is before the 1919 outbreak in the Philippines. Again they had an invasion in 1931, before we had the last outbreak which started in 1932. Borneo is a large, sparsely populated island and since there is no coöperative work between the Philippines and Borneo for locust scouting and control, any swarms developing in Borneo and later invading the Philippines first through Sulu or Cotabato via Celebes [1] may easily escape notice. Borneo has an area of about 290,000 square miles, about two and a half times that of the Philippines, and with a very small population of only about 2,000,000, and as has already been pointed out the breeding or outbreak area of the Migratory Locust need not be large.

[1] It may be of interest to note in this connection that in the old Bureau of Agriculture's compilation of locust infestations there was a notation made that in 1912 dense locust swarms from Celebes and Moluccas alighted in Agusan, Mindanao.

DESCRIPTION AND DISTRIBUTION OF THE SOLITARY PHASE

Since 1932, specimens like those from Cebu, have been collected from other provinces. During August and September, 1935, several were collected from the Bureau of Plant Industry grounds in Manila, which was quite far from migratory swarm infestations then occurring in Masbate and Southern Luzon (Tayabas, Albay, Camarines Sur, and other Bicol provinces). During 1936, specimens were collected not only from Manila, but also farther north in Pampanga, Nueva Vizcaya, Isabela, and Pangasinan. During 1937, specimens were also collected from Abra and Ilocos Sur, which are still much farther north. The majority of the specimens collected are in the main green on the vertex, genae, prothorax and meso and meta-pleura, including the hind femora (plate 2, figs. 1 and 2). Others are brown (plate 3, figs. 1 and 2) and in some specimens the pronotum and vertex are dark. The pronotal keel, which distinguishes the solitary phase from the migratory phase whose pronotum is depressed or saddle-shaped, is especially pronounced in the brown specimens, that is distinctly arched, whereas in most of the green specimens it is mostly straight. Besides the keeled pronota in both sexes, solitary locust specimens are further distinguished from migratory individuals by the fact that the males are conspicuously smaller than the females. Locusts of the solitary phase, especially hoppers, were observed to have a strong tendency to resemble the color of their surroundings.

Following the classification of Uvarov and Zolotarevsky (1929) who stated, among other things, that the term *solitaria* is to be *applied to the extreme forms, the solitary individuals present in a locality, where swarms do not exist or have not existed, within at least one preceding generation,* the writer was justified in classifying the specimens collected from the aforementioned provinces as belonging to the phase *solitaria* of our Oriental species (*Locusta migratoria manilensis* Meyen), as aside from the identification by Doctor Uvarov of similar specimens from Cebu, it was definitely known that *no migratory swarm existed or had existed in the localities concerned prior to the collection of specimens.* This is particularly true in the case of those collected from Abra and Ilocos Sur, which were remote from migratory swarm infestations that were then found in Masbate and Southern Luzon. Moreover, these solitary forms are apparently well distributed there and are locally known as

"paddagan" and are even caught for food during the rice harvest season, that is during November to January. Specimens have also been collected in Cotabato, where migratory swarms have not existed for over two years, so far as extensive scouting work by fieldmen of the Bureau of Plant Industry shows. Latest observations indicate that these solitary locusts are quite common in many cultivated fields in many places during the rainy season (June to November) but are quite scarce, if at all found, during the height of the dry season (February to May).

Although the criterion of Uvarov and Zolotarevsky and the identification made by the former from specimens sent him appeared to be sufficient reason for classifying the solitary locusts collected from different places as belonging to the phase *solitaria* of the Oriental Migratory Locust, it was deemed necessary to breed some of these and also to take measurements of these and other specimens as were available as a basis for further work. The detailed results of the breeding work with these and other specimens collected will be presented in another paper. But it may be stated here in advance that in the breeding work individual locusts possessing *transiens* characters were produced from the solitary locust specimens collected from different places. For one thing, most of the hoppers in the mass cultures possessed the migratory colors—black and orange yellow or brick color. On the other hand, when the hoppers were reared separately in wire cages and breeding jars, they were mostly green. Others were grayish brown and still others had shades of these colors, depending on the cages used. They had a tendency to resemble their surroundings and retain the solitary characteristics of their parents. It may also be stated here that adult locusts reared from hoppers that hatched from eggs laid by migratory swarms showed solitary phase characters when reared separately in cages and breeding jars. These results prove definitely that the solitary locusts found in cultivated fields and grasslands and specimens of which appear in local collections as *Locusta australis* Saussure really represent the solitary phase of the Oriental Migratory Locust. Such locusts should not be confused with the common locust or grasshopper, *Gastrimargus marmoratus* (plate 5, fig. 1) which is somewhat smaller, with a prominent pinkish brown band on each side of the prothorax, basal or proximal half of the outer wings markedly ornamented with grayish spots and bands and whose tibiae are mostly pinkish red in color. The latter insect is a slower

flyer, the flights short and directed upwards and makes a peculiar noise in flight.[2]

Table 2 shows the measurements of specimens collected from different places, which were bred in the Entomology Laboratory, Manila, while table 3 gives the measurements of other solitary locust specimens, three females having been collected from Enrile, Cagayan and the rest from Cotabato, where swarms of the phase *transiens* or of the phase *migratoria* have not been found since April, 1938. The only small swarm found so far in Cotabato since that time was that of another species (*Acridium cognatum?*). A comparison of the average ratios of the measurements in table 2 with those of Uvarov shows that the specimens are wholly *solitaria* in character. The ratios show that compared with those of the phases *transiens* and *gregaria* the insects of the phase *solitaria* have relatively shorter wings, longer femora and longer and higher pronota but such pronota are thinner. The average ratios shown in table 3 likewise show that the female solitary locusts collected from Cotabato and Cagayan are wholly *solitaria* in character. In the case of the males which were all collected from Cotabato, most of them are certainly *solitaria* in character. However, the three males (4, 5, and 6) collected there recently, that is May 15, 1940, appear to show more *transiens* characters in their M/C ratios. Whether this is an indication of a possible trend in development in Cotabato toward the phase *transiens,* leading eventually to another outbreak, the extensive locust scouting work being conducted in that province should show. It may be stated in this connection that, Central and Southern Cotabato having been opened up to colonization, many of the grassland areas are being put into cultivation. Whether this and the conversion of more extensive grasslands to pasture and the wider burning of the grass in such lands, as a result of the ever-increasing population in those regions, will have any effect at all toward minimizing or entirely preventing the development of migratory swarms, so that no invasion of other provinces takes place, remains to be seen. If this turns out to be the case, the question as to whether or not other provinces, like Davao, Negros, Mindoro, Isabela, Mountain Province, Cagayan, etc. are capable of breeding migratory swarms, as other investigators believe, as Goseco (1933) for instance, may be solved.

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[2] Other species that may be mistaken for the solitary phase of the Migratory Locust are *Valanga nigricornis* and *Acridium cognatum?=Melicodes tenebrosa?* (see plate 5).

The relatively shorter wings and longer femora seem to fit the relatively inactive life of the individual locusts belonging to the solitary phase—that is, they seldom fly and do not do so for considerable distances, unlike those of the migratory phase which even cross large bodies of sea. It is logical to deduce, therefore, that other criteria being considered, the lower the E/F ratio a solitary locust specimen has, the shorter the wings in relation to the femur and the more is it truly *solitaria* in character. And of all ratios, the E/F ratio is the most reliable as a basis of comparison for the different phases as the tegmina or outer wings and the femora can be more accurately measured than the length, height and constriction of the pronotum and width of head. Moreover, according to Johnston (1936), this ratio is considered the most widely useful in application, which may be due to the fact that organs more intimately connected

TABLE 3.—*Solitary locusts collected from Cotabato since April, 1938, when no more migratory swarms were found and since which date the province has been declared under observation. Three female specimens from Enrile, Cagayan are included.*

Number	Sex	E	F	P	H	M	C	E/F	P/C	H/C	M/C
1	F	4.66	2.65	1.03	0.95	0.70	0.73	1.79	1.41	1.30	0.96
2	F	4.61	2.69	0.98	0.92	0.64	0.69	1.71	1.42	1.33	0.92
3	F	4.74	2.88	1.12	0.96	0.70	0.74	1.64	1.51	1.29	0.94
4	F	4.95	2.73	1.02	0.95	0.71	0.74	1.81	1.38	1.28	0.96
5	F	4.82	2.65	0.96	0.94	0.70	0.73	1.82	1.32	1.29	0.96
6	F	4.80	2.66	1.05	0.90	0.66	0.70	1.80	1.46	1.25	0.92
7	F	4.55	2.72	0.92	0.86	0.65	0.70	1.67	1.31	1.23	0.93
8	F	4.60	2.62	1.05	0.92	0.64	0.69	1.60	1.52	1.33	0.93
9	F	4.70	2.65	1.05	0.93	0.66	0.70	1.77	1.50	1.33	0.90
10	F	4.34	2.36	0.97	0.83	0.61	0.70	1.84	1.39	1.12	0.89
11	F	4.95	2.94	1.12	1.01	0.71	0.78	1.68	1.43	1.29	0.91
Totals		51.72	29.55	11.27	10.17	7.38	7.90				
Average ratios								1.75	1.42	1.28	0.93
1	M	3.39	1.92	0.74	0.65	0.45	0.50	1.76	1.48	1.30	0.90
2	M	3.34	1.95	0.78	0.64	0.47	0.52	1.71	1.50	1.23	0.90
3	M	3.48	2.00	0.70	0.65	0.47	0.51	1.74	1.37	1.27	0.92
4	N	3.71	2.09	0.80	0.69	0.47	0.54	1.77	1.48	1.27	0.87
5	M	3.75	2.06	0.82	0.69	0.48	0.55	1.82	1.49	1.25	0.87
6	M	3.31	1.92	0.75	0.63	0.42	0.49	1.72	1.53	1.31	0.86
Totals		20.98	11.94	4.59	3.95	2.76	3.11				
Average ratios								1.75	1.47	1.27	0.88

NOTE.—Females Nos. 1, 2, and 3 were collected from Buayan, Cotabato, May, 1938. Females 7, 8, 9, and 10 were also collected from Buayan, May 29 to 31, 1939. Nos 4, 5, and 6 were collected from Enrile, Cagayan, September 14, 1938, while No. 11 was collected from Koronadal, Cotabato, May 15, 1940.

Males No. 1 was collected from Isulan, Cotabato, May, 1938; 2 and 3 from Buayan, Cotabato, May 29–31, 1939; and 4, 5, and 6 from Koronadal, Cotabato, May 15, 1940. (Most of the Cotabato specimens were collected by T. Villalon and the Cagayan specimens by A. Valdivia, of the Plant Pest and Disease Control Division).

with movement are the first to be affected by change of habits and are probably least affected by shrinkage as a result of the drying of the specimens. That a lower E/F ratio, other characters being considered, is indicative of a more truly phase *solitaria* character seems to be borne out by the solitary locust specimens, which were collected from places more or less remote from migratory swarm infestations, especially by those given in table 2, all the E/F ratios of which are below 1.80. Most of those given in table 3 likewise have E/F ratios below 1.80, and in both tables some specimens have E/F ratios falling below 1.70. It may, therefore, be suggested that, other characters being considered, such specimens with E/F ratios falling below 1.80 may be classified as belonging to the phase *solitaria*. Those with ratios falling below 1.70 probably represent the extreme solitary forms of the Oriental Migratory Locust.

TABLE 4.—*Average ratios for the different phases of the Oriental Migratory Locust.*

Phases	E/F	P/C	H/C	M/C
Phase *solitaria:*				
Male	1.73	1.48	1.33	0.91
Female	1.74	1.44	1.38	0.92
Phase *transiens:*				
Male	1.83	1.25	1.19	0.86
Female	1.91	1.25	1.20	0.88
Phase *gregaria:*				
Male	2.12	1.10	1.05	0.81
Female	2.18	1.10	1.04	0.83

In accordance with the foregoing suggestion, the average of the average ratios for the males in tables 1, 2, and 3, which are E/F 1.74; P/C 1.47; H/C 1.32; M/C 0.90; and the average of the average ratios for the females in tables 2 and 3, which are 1.74; 1.43; 1.31 and 0.92 (the females in table 1 being more *transiens* in E/F character, the average ratios of their measurements are not included), may be used (instead of Uvarov's average ratios—for male E/F 1.87; P/C 1.33; H/C 1.25; M/C 0.91 and for female 1.92; 1.53; 1.31 and 0.92, respectively—which were calculated from measurements of only one male and one female from China, which specimens appear to be more *solitaria* than *transiens* in their E/F ratios) in ascertaining whether any given specimen belongs to the phase *solitaria* as distinct from *transiens* or *gregaria*. But mainly because the specimens in table 2 have been bred, collected from places more or less remote from migratory swarm infestations and all of

them appear to be distinctly solitary in E/F ratios, the average ratios of the measurements of these, which are, for male E/F 1.73; P/C 1.48; H/C 1.33; M/C 0.91 and for female 1.74; 1.44; 1.38 and 0.92, respectively, may logically better be used instead of the average of the average ratios as suggested. At any rate the figures differ but slightly and either set of average ratios may be used. But, because of the reasons set forth, the ratios from the bred specimens have been used in table 4, which gives all the average ratios for all the phases, thus facilitating the placement of any given specimen. The figures for the phase *transiens* in said table are the average ratios of Uvarov for all such specimens, including those from Los Baños, and those for *gregaria* are the average of the average ratios of Uvarov (1936) and of Uichanco and Gines (1937), with the exception of the ratios M/C (0.81 and 0.83), which are solely of Uvarov, as the latter authors do not give any corresponding averages in their table 8, comparing their average ratios with the corresponding ratios of Uvarov.

DEVELOPMENT OF MIGRATORY SWARMS

From the foregoing observations, it is apparent that the solitary forms of the Oriental Migratory Locust are widely distributed in the Philippines. In places, these at times produce thin swarms of the phase *transiens,* which seldom, if ever, succeed in developing into the migratory stage both as to morphology and habits. This is especially true in provinces which are more or less well populated and where most of the land has been brought into cultivation. The changes in environmental conditions through cultivation, grazing, etc. perhaps render the development of *transiens* swarms abortive. Likewise, frequent burning of the uncultivated grasslands perhaps also contribute to this end, to say nothing of the rôle of natural enemies and the fact that in many places the insects are caught for food. Any factor that contributes to the lessening of the density of a swarm will tend to speed up the change in development into the solitary phase. Thus, according to Uvarov (1928) birds are important in this respect, not because they eat many locusts but because they scatter the swarms and thus speed up the process of transformation into solitary phase. Birds are of great help in hastening the disappearance of small scattered migratory swarms, such as those left after extensive general campaigns. Uvarov (1928) also stated that the regularity of the process of transformation into the swarming or migratory phase "may be

sometimes destroyed by the interference of man, who scatters the bands of hoppers and the swarms when they are just formed, and this stops or at least retards the process. In some cases such interference is regular, consisting in artificial changes of the ecological conditions in the permanent breeding grounds so that even the initial increase in numbers of the insects becomes difficult. This is what happened with *Locusta migratoria*, many breeding grounds of which have ceased to function as a result of the interference of man; the same is probably the cause of the disappearance of the swarming phase of the Rocky Mountain Locust, though it cannot be stated definitely."

It is apparently in the vast uninhabited interior places in Mindanao, particularly in Cotabato, where the Oriental Migratory Locust succeeds in developing into dense migratory swarms thus giving rise to recurrent outbreaks. Hence, it is in Cotabato where most of the locust scouting is being and will be conducted in order to locate initial swarms (phase *transiens*) and kill these by all methods known, such as by poisoned baits and dusting with arsenical and derris powders,[3] before they have a chance to develop into migratory swarms. It is also there where observations with the object of delimiting the outbreak areas of the migratory locust should be made. Once such areas are delimited, a study of the various local factors that influence outbreaks may then be conducted to the end that definite steps may be taken whereby conditions in the outbreak areas may be modified, thus at least curtailing, if not entirely preventing, the development of migratory swarms.

Since June, 1939, when Masbate, the Bicol provinces and Tayabas were placed under observation after the last swarms in those provinces were controlled, extensive locust scouting work was continued there and in Mindanao, particularly Cotabato. Cotabato was placed under observation in April, 1938. It is interesting to note that since then no swarm of the phase *transiens* or phase *gregaria* has been found. However, locust specimens, which, as has already been shown, belong to the phase *solitaria*, have been collected there, as well as in certain other places. That locust swarms have not been encountered in Cotabato in spite of the extensive scouting work there seems to

[3] Laboratory and field tests by the writer show that fine derris dust with a rotenone content of 2 to 4 per cent is deadly against the flyers and hoppers. Derris powder may, therefore, be employed instead of arsenicals the extensive use of which is objected to because of the risk to stock and operators.

contradict the view that swarms, whether of the phase *transiens* or *gregaria* from which a new outbreak may arise, are found in Cotabato all the time. From this it may be deduced that a new outbreak of the Oriental Migratory Locust must necessarily start with the solitary phase.

SUMMARY

A brief review of the phase theory in connection with the biology of migratory locusts is given.

An explanation on how and why solitary locusts come together, breed and produce thin or loose swarms of the phase *transiens*, these eventually developing into migratory swarms (phase *gregaria* or *migratoria*), is also given.

The duration and intervals of locust outbreaks in the Philippines are likewise given.

Identification of specimens by Dr. B. P. Uvarov, measurements of specimens and breeding work show conclusively that the solitary locusts, formerly identified as *Locusta australis* Saussure, in reality represent the solitary phase of the Oriental Migratory Locust, *Locusta migratoria manilensis* Meyen. Specimens belonging to the solitary phase of this phase are described. These should not be confused with the common grasshopper, *Gastrimargus marmoratus*, a smaller species which is a slow flyer and with a prominent pinkish brown band on each side of the prothorax, basal half of outer wings markedly ornamented with grayish spots and bands and with pinkish red tibiae.

Measurements of such specimens as were available are given, as a basis for further work. Other characters considered, such specimens with E/F ratios falling below 1.80 may be classified as belonging to the phase *solitaria*. Specimens with E/F ratios falling below 1.70 probably represent the extreme solitary forms of the species. The average ratios from the specimens bred, as given in table 2, which are for male E/F 1.73; P/C 1.48; H/C 1.33; M/C 0.91; and for female E/F 1.74; P/C 1.44; H/C 1.38; M/C 0.92, may for the reasons set forth preferably be used (instead of those of Uvarov's ratios which were calculated from measurements of only two specimens—one male and one female) for definitely distinguishing the phase *solitaria* from the *transiens* and *gregaria* or *migratoria* (using in this connection the average ratios of Uvarov for the phase *transiens* and Uichanco and Gines' ratios for *migratoria* or more logically

the average of the average ratios of Uvarov and Uichanco and Gines) considering also, of course, other characters and criteria. To facilitate the placement of any given specimen table 4 should be referred to.

Locusts belonging to the solitary phase of the Oriental Migratory Locust are apparently well distributed in the Philippines. During the rainy season specimens may be found in cultivated fields and grasslands in many provinces during June to November, but scarce during February to May, that is during the greater part of the dry season.

Loose or thin swarms of the phase *transiens* appear here and there in cultivated and grassland areas in many provinces. Owing perhaps to changed environmental conditions through cultivation, grazing, burning in grasslands, catching of the insects by persons for food, etc., these *transiens* swarms seldom, if ever, succeed in developing into the migratory phase. The sporadic appearance of such thin swarms during periods when there are no migratory swarms have proved so far to be a reliable and practical basis for predicting the occurrence of a new outbreak and as a guide for conducting the scouting work in the permanent breeding places or outbreak areas.

As far as observations and records show, the outbreak areas of *Locusta migratoria manilensis* Meyen are found in Cotabato. Available evidence also tends to show that swarms, whether of the phase *transiens* or phase *migratoria,* do not exist in Cotabato all the time and that fresh outbreaks must necessarily start from the solitary, in accordance with the phase theory and outbreak cycles. That the latter is more likely the case may be shown theoretically, aside from the results of the extensive scouting work. Some of the solitary females bred in the Entomology Laboratory in Manila had produced more than 500 nymphs or hoppers. Allowing 300 as the average number of young that a female can produce, it has been calculated that a pair of solitary locusts may produce in the third generation, that is, in about a year's time, an enormous amount of progeny numbering 1,012,500,000. This would amount to over 42,000 cavanes and the swarm would cover roughly about two square miles. When an outbreak impends the environmental resistance is likely to be low; otherwise dense swarms will not be formed and an outbreak will not take place. The point suggested by these considerations is that there need not be a swarm to start an outbreak—that is, a relatively few solitary locusts may suffice.

The possibility of locust swarms invading the Philippines from Borneo, a large thinly populated island more than twice the area of the Philippines, in the same way that swarms from Luzon also invaded Formosa, as has been reported by certain Japanese investigators, is discussed. The existence of the solitary phase of the Oriental Migratory Locust in Borneo and the occurrence of outbreaks in Borneo shortly before outbreaks in the Philippines point to such a possibility. At least, swarms coming from Borneo may contribute to infestations, or join swarms of local origin.

Since Cotabato, judging from the records, is likely the main permanent breeding area or outbreak center of the Oriental Migratory Locust, it is accordingly there that most of the scouting and control work, with the object of preventing the development of large migratory swarms is being and will be conducted. A study of the factors that influence outbreaks may be centered in Cotabato to the end that definite steps may be taken whereby conditions in the outbreak area or areas may be modified or altered so as to curtail, if not entirely prevent, the development of migratory swarms. However, locust scouting and observations should also be made in other provinces that are more or less sparsely populated in order to secure definite data on the solitary phase, on initial or *transiens* swarms and on the behavior of these with due consideration to environmental factors.

With the opening up of Central and Southern Cotabato in particular to colonization, many of the grassland areas there are being put into cultivation. Whether this, and conversion of more grasslands to pasture and the wider burning of grasslands as a result of the ever-increasing population in those regions, will have any effect toward minimizing, or entirely preventing, the development of migratory swarms in Cotabato so that no invasions in other provinces will take place, remains to be seen.

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ILLUSTRATIONS

PLATE 1

Diagram of measurements to be taken on a locust for calculating biometric ratios (Redrawn from the 1936 Proceedings of the Fourth International Locust Conference, Cairo, Egypt):

E—Length of elytron, or tegmen or outer wing
F—Length of posterior femur
P—Length of pronotum
M—Width of constriction of pronotum
H—Height of pronotum
C—Maximum width of head

PLATE 2

FIGS. 1 and 2. Male and female green forms of the solitary phase of the Oriental Migratory Locust, *Locusta migratoria manilensis* Meyen.

3. A female locust belonging to the migratory phase. Note the depressed or saddle-shaped form of the prothorax in contrast to that of the solitary, the pronotum of which is ridged, keeled, convex or straight. Figures enlarged.

PLATE 3

FIGS. 1 and 2. Male and female brown forms of the solitary phase of the Oriental Migratory Locust. Figures enlarged.

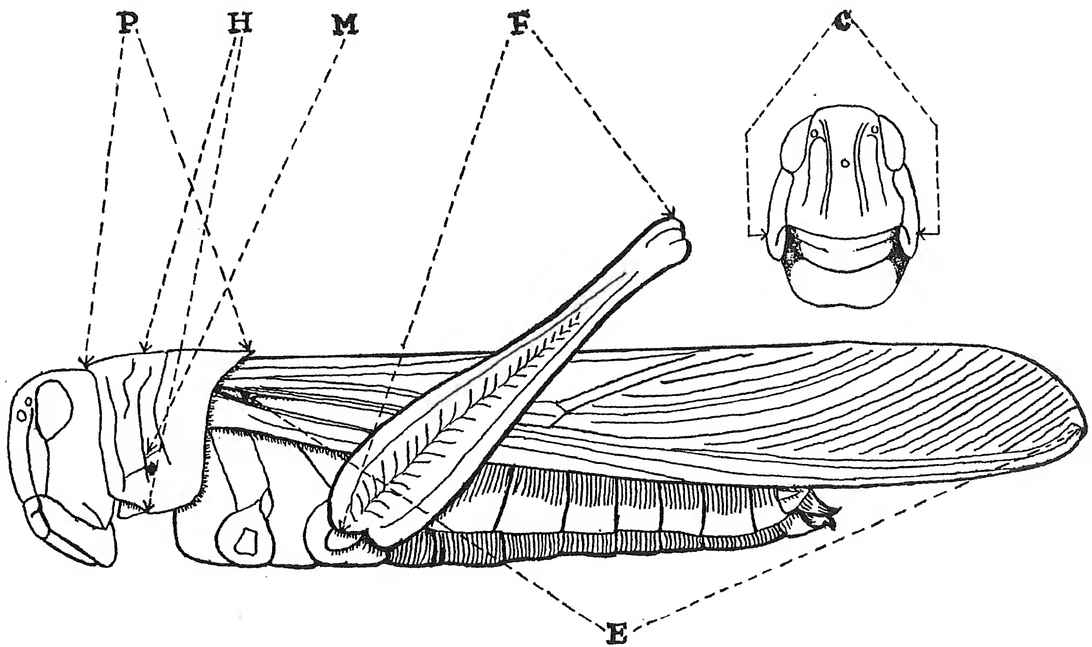
PLATE 4

A map of the Philippines showing the general movement of locust swarms during the 1932-1939 outbreak—as indicated by arrows. Shaded area in Cotabato and part of Davao indicates the most probable outbreak area of the species. (Extensive campaigns were conducted in all the places visited by swarms. Arsenical dust poisons, poison baits and soap solutions were used against hoppers—along with usual mechanical methods employed in general campaigns under Locust Act No. 2472. These apparently account chiefly for the relatively short duration of the said outbreak and the fact that it had not become so widespread, swarms having reached only as far north as Laguna and Batangas).

PLATE 5

Other species of locusts liable to be mistaken (in fact have been mistaken) for the solitary phase of the Oriental Migratory Locust.

FIG. 1. *Gastrimargus marmoratus* (green form), about 1x.
2. *Acridium cognatum* Stål (*Melicodes tenebrosa* Wlk.) (?), about 1x.
3. *Valanga* (*Cyrthacanthacris*) *nigricornis* Burm. (Identification verified by Dr. P. van der Goot of the Institute for Plant Diseases and Entomology, Buitenzorg, Java), about 1x.



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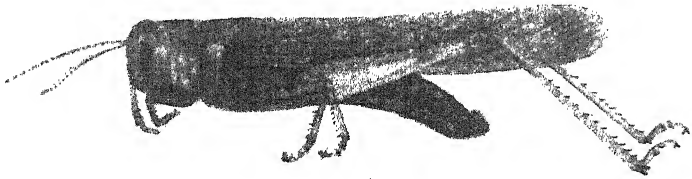

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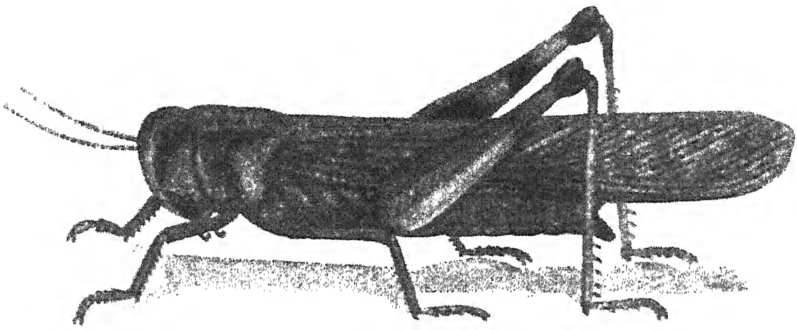

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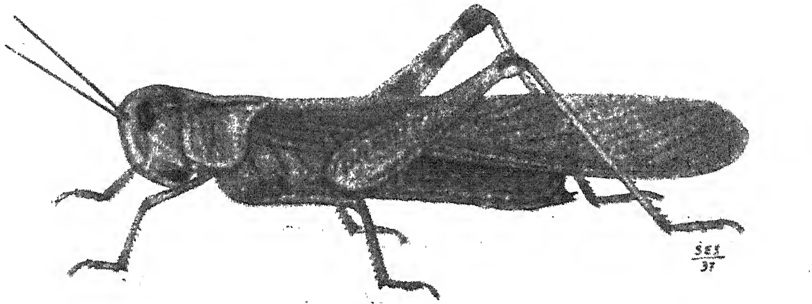

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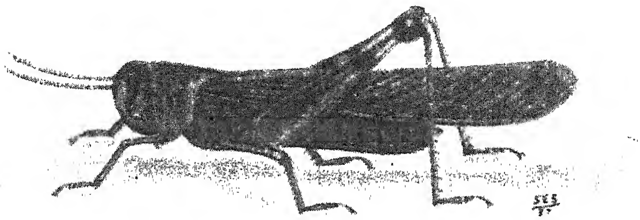

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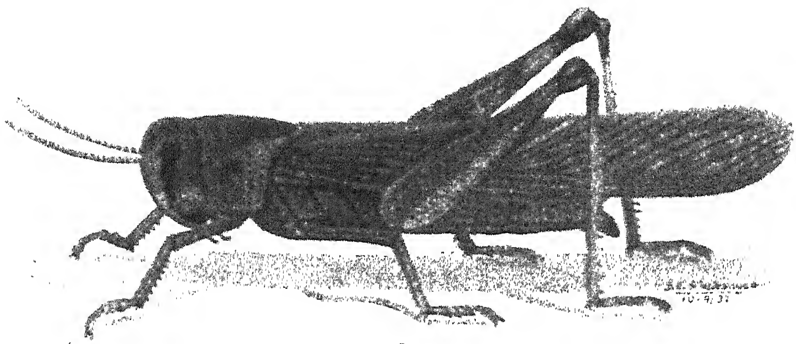

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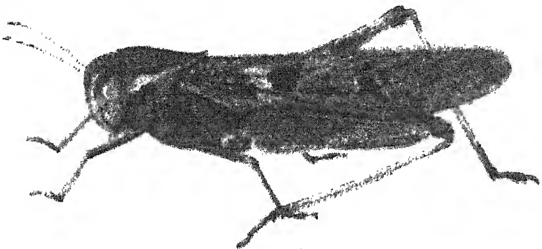

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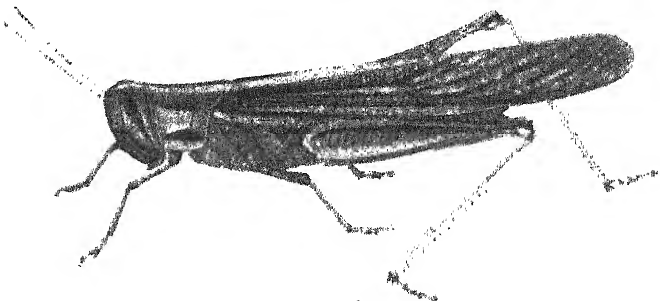

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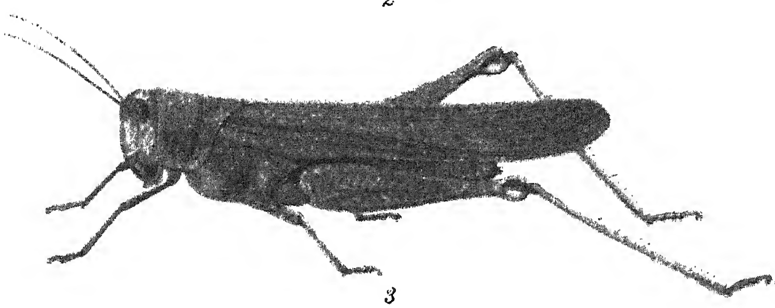

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PLATE 5.

THE EFFECT OF VOLCANIC ASH EJECTED FROM MAYON VOLCANO UPON THE GROWTH OF TOBACCO[1]

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THREE PLATES AND ONE TEXT FIGURE

Mayon Volcano has erupted many times. As cited by Adams and Pratt[2] its first eruption was in the year 1616, the second and succeeding eruptions being in 1660, 1800, 1814, 1827, 1845, 1846, 1851, 1853, 1855, 1871, 1872, 1873, 1881–1882, 1885, 1885–1887, 1888, 1890, 1891, 1892, 1893, 1895, 1896, and 1897. The last was in June, 1938.

When Mayon Volcano erupted in 1897, Padre Jose Coronas stated that hot ashes fell in Tabaco, and, according to one report, 50 centimeters of ashes fell in 24 hours in that town, and in Tiwi, during the same interval, 15 to 20 centimeters. Another report states that 15 centimeters of ashes fell in Tabaco. Small stones, the size of pigeon eggs, were reported to have fallen in Ligao and in Camalig. In Albay and Daraga the fall of ashes was about 1,002 millimeters and in Legaspi less. In Virac, Catanduanes Island, 5 to 6 centimeters of ashes and the conflicting statements as to their depth are explained by Coronas as being due to the variation and action of the wind.

In June, 1938, when Mayon Volcano erupted, 2 to 5 millimeters thick of ashes fell at Daraga, Camalig, Guinobatan, and Ligao. At barrio Midela about 3.5 cm. thick of ashes were found on an empty river bed. No appreciable amount of volcanic ash fell on the nearby towns on the north and east sides of Mayon Volcano, but on the western part particularly in the municipalities of Camalig, Guinobatan, and Ligao, the leaves of abaca and banana plants were scorched badly as a result of the accumulation of fine volcanic ash on the leaves of these plants (text fig. 1). What is the subsequent effect of the volcanic ash deposited on the soil upon the later growth of the plants? No satisfactory answer could be given to the question at that time except by inference from the results of the analyses of the Mayon volcanic dust collected by Sherman(10). She found .091 per cent nitrogen, 0.266 per cent phosphorus, 1.605 per cent potash and 0.023 per cent acidity. These substances which are

[1] Received for publication September 9, 1940.

[2] Cited by George I. Adams and Wallace E. Pratt. Geological reconnoissance of southwestern Luzon. Philip. Journ. Sci. 6 (1911) No. 6.

found in the volcanic ash, when added to the soil in soluble form especially when the soil is deficient in any one of them, are beneficial to the growth of the plants. But are those elements reported by Sherman the only substances present in the ejecta of Mayon Volcano? According to Cox's (1) report on the finer ejecta of Taal Volcano, a number of different substances were found as can be seen in table 1.

TABLE 1.—*Analyses of the finer ejecta from Taal Volcano and of volcanic tuff.*

Constituent	Finest ash from upper southern slope of Taal		Ejecta from area where mud was 1 cm. deep		Tuff from Guadalupe			
	I[a]	II[b]	III[a]	IV[b]	V	VI	VII	VIII
	Per cent	*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Per cent*
NOT READILY SOLUBLE IN WATER								
Silica (SiO_2)	45.76	50.79	44.63	50.94	56.84	56.55	59.27	57.26
Alumina (Al_2O_3)	14.57	16.17	13.33	15.22	18.46 [c]	22.34 [c]	17.06	16.95
Ferric oxide (Fe_2O_3)	2.89	3.20	3.24	3.70	0.75	1.87	2.16	-------
Ferrous oxide (FeO)	5.20	5.77	5.04	5.76	2.51	-------	2.61	7.55
Lime (CaO)	6.94	7.70	6.25	7.13	4.78	4.74	3.37	3.56
Magnesia (MgO)	2.59	2.87	2.70	3.08	1.59	2.36	1.52	1.10
Soda (Na_2O)	None	-------	None	-------	4.12	2.38	.49	1.64
Potash (K_2O)	None	-------	None	-------	2.72	2.84	3.63	1.86
Loss on ignition	[d] 1.18	[d] 1.31	[d] 1.19	[d] 1.36	6.95	4.86	6.42	7.65
Water (H_2O) (below 105–110°)	5.03	None	6.35	None	1.76	2.51	1.34	1.43
Titanic oxide (TiO_2)	1.20	1.33	1.14	1.30	(e)	(e)	0.83	0.91
Manganese oxide (Mn_3O_4)	Trace	Trace	Trace	Trace	Trace	-------	Trace	0.23
Sulphuric anhydride (SO_3)	9.49	10.53	10.11	11.54	-------	-------	-------	-------
Free sulphur (S)	0.45	0.50	0.37	0.42	-------	-------	-------	-------
Phosphoric anhydride (P_2O_5)	0.05	0.06	0.03	0.03	-------	-------	-------	-------
READILY SOLUBLE IN WATER[f]								
Silica (SiO_2)	0.82	-------	0.95	-------	-------	-------	-------	-------
Iron and aluminum oxides (R_2O_3)	0.01	-------	Trace	-------	-------	-------	-------	-------
Lime (CaO)	0.16	-------	0.32	-------	-------	-------	-------	-------
Magnesia (MgO)	None	-------	None	-------	-------	-------	-------	-------
Soda (Na_2O)	1.51	-------	2.03	-------	-------	-------	-------	-------
Potash (K_2O)	1.34	-------	1.25	-------	-------	-------	-------	-------
Manganese oxide (Mn_3O_4)	Trace	-------	Trace	-------	-------	-------	-------	-------
Sulphuric anhydride (SO_3)	0.30	-------	0.60	-------	-------	-------	-------	-------
Phosphoric anhydride (P_2O_5)	None	-------	None	-------	-------	-------	-------	-------
Chlorine (Cl)	0.74	-------	0.95	-------	-------	-------	-------	-------
Total	100.23	100.23	100.48	100.48	100.48	100.44	100.70	100.14

[a] Analyzed mostly by Dr. T. Dar Juan.

[b] These numbers are approximately comparable to Columns V to VIII, although it is quite probable that in time the sulphates would be leached out or hydrolysed and give a closer relationship to the tuff which is found in various places in the Island of Luzon than that shown by these analyses.

[c] Includes titanic oxide (TiO_2).

[d] Actual loss on ignition—(moisture + sulphuric anhydride + ½ sulphur).

[e] Included in alumina (Al_2O_3).

[f] Three months after collection.

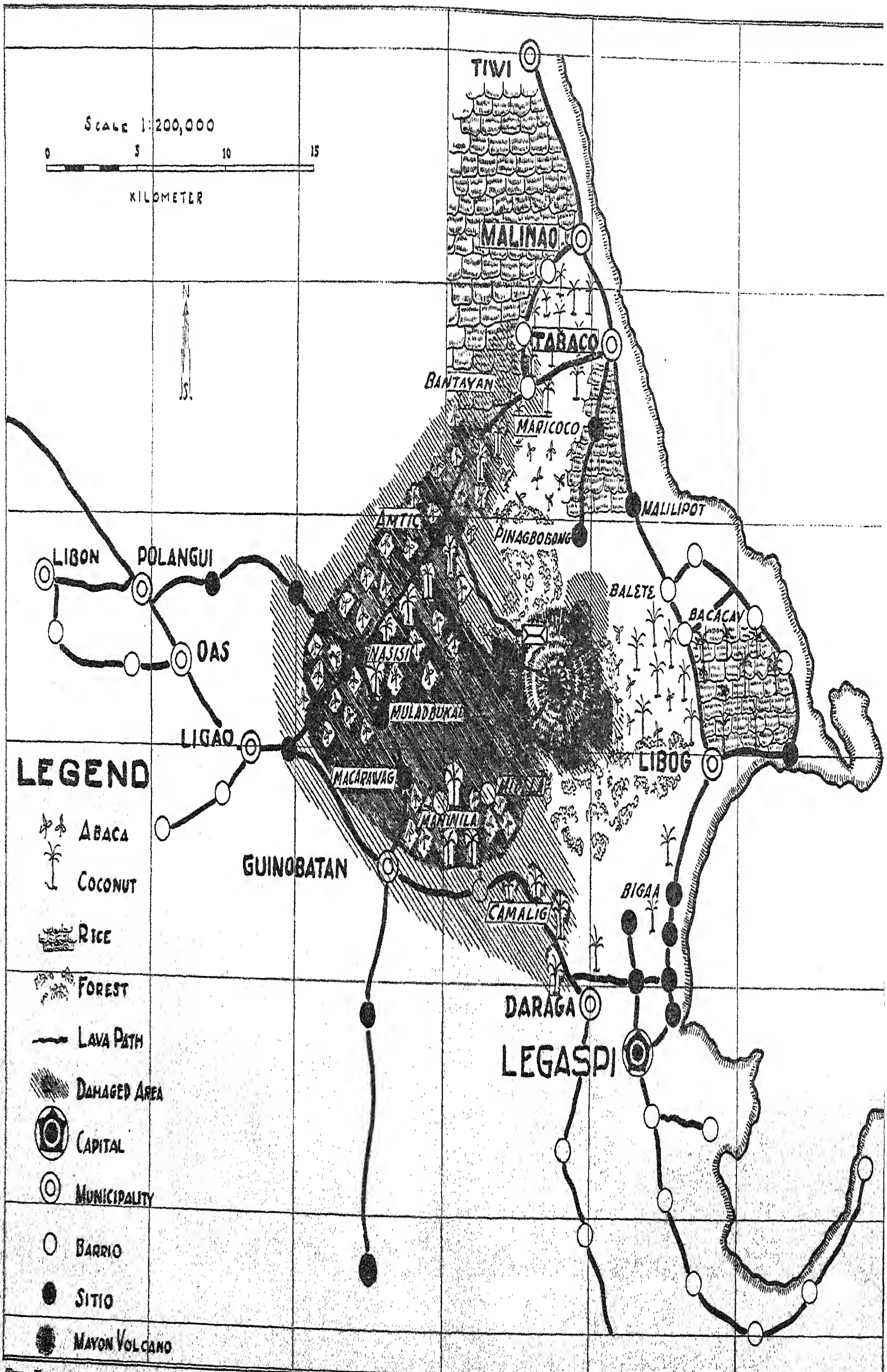
It can be seen in table 1 that at least twelve inorganic substances were reported present in the fine ejecta of Taal Volcano, among which silica was highest (44.63 to 59.27 per cent), and alumina was second (13.33 to 22.34 per cent). Nitrogen was absent. Very likely the same kind of substances found in the fine ejecta of Taal Volcano may also be present in the ashes ejected by Mayon Volcano. And, if this is the case, the effect of the aluminum in the volcanic ash upon the plant is worthy of study because, according to Ruprecht(9), aluminum sulphate solution has a very toxic action on clover seedlings when present in a medium greater than 40 parts per 1,000,000. Similarly, Miyake(7) showed that aluminum chloride is toxic to rice seedlings in concentrations greater than N/7,500. Further, Mirasol(6) and McLean and Gilbert(4) reported the high toxic effect of aluminum compounds on plants like barley and lettuce when present in an appreciable quantity in the culture medium. But later in 1928, McLean and Gilbert(5) also observed that very low concentrations of aluminum (3 to 13 ppm) were stimulatory to plants. These findings make the study important because of the absence of a quantitative determination of the effect of the volcanic dust upon the growth of the tobacco plant [3] and because of the incompleteness [4] of the analyses of the composition of the volcanic dust as reported by Sherman. This needed information prompted the studies conducted in the laboratory of the Tobacco Research Section, Bureau of Plant Industry during the years 1938 and 1939.

MATERIALS AND METHOD

Collection of volcanic ash, ordinary garden soil and their treatments.—On June 20, 1938, volcanic ash was gathered from the surface of galvanized iron roofs of houses in the different barrios of the municipalities of Guinobatan and Ligao, Albay. Sufficient samples were secured and placed in jute bags for shipment to the Central Office, Manila, for laboratory study. Immediately after receipt of the material in Manila, enough sample for chemical analysis was placed into a bottle, stoppered,

[3] Tobacco plant was used as subject of study because it is one of the best plant indicators for soil conditions.

[4] Dr. N. L. Galvez of the College of Agriculture gathered some of the fine ejecta of Mayon Volcano at the same time with the author and reported the chemical and physical examinations of the composition of his samples in the Philippine Agriculturist 27 (1939) 765–774.



TEXT FIGURE 1. A portion of the map of th...

and sent to the Bureau of Science to be analyzed for total silica, alumina, ferric oxide, ferrous oxide, lime, magnesia, soda, potash, nitrogen, phosphorus, manganese, sulphuric anhydride and free sulphur and for pH value determination.

Sufficient ordinary garden soil for experimentation was also gathered at the Central Experiment Station field, Manila, and placed in the greenhouse to dry. The soil was then thoroughly mixed. A representative sample of the soil was also taken and placed into a bottle, stoppered, and sent together with the volcanic ash to the Bureau of Science for total nitrogen, phosphorus, potassium and pH value determination.

Preparation and conduction of pot cultures.—Three sets of pot cultures designated as test A, test B and test C were conducted. Tests A and B were performed at the same time and the cultures were placed practically under the same aërial environmental conditions. Test C was conducted after the results of tests A and B were obtained.

Test A consisted of sixteen pot cultures and was treated as follows: Two pots were filled with eight kilograms of ordinary air-dry garden soil previously prepared and into another two pots, eight kilograms of air-dry volcanic ash were placed. The remaining six pairs of pots contained also eight kilograms of a mixture of garden soil and volcanic ash of varying percentages, viz., five, ten, twenty, thirty, forty, and fifty. The five per cent mixture (garden soil and volcanic ash) was prepared by replacing 400 grams of garden soil with an equivalent weight of volcanic ash. The two substances (400 gms. volcanic ash and 7,600 gms. garden soil) were mixed and the combination was designated as a five per cent mixture. The other percentages were prepared similarly and accordingly. The soil medium in each of the sixteen pots was moistened with water to its optimum moisture-holding capacity. A good-sized tobacco seedling was planted in each pot. The pot cultures were then weighed and placed in the greenhouse. Whenever the plants needed water, the culture pots were reweighed and the lost weights were replaced by pouring water into the pots.

Test B was a repetition of test A except for the method of watering the plants. The pot cultures (test B) were placed in shallow containers with water so that when the pot cultures were dipped into the water, a depth of an inch of water outside each pot was observed. The depth of water in the water container was regulated by a hole bored through one of its sides at a height of one inch from the bottom. The earthen pots

being porous, the plants were supplied with water by capillary attraction through the bottom and wall of the pots. Water was added into the water receptacle as frequently as was necessary (plate 2). Test B was placed side by side with test A in the greenhouse. At the termination of the test the moisture content of the soil contained in the different pot cultures was ascertained, and the results expressed on the dry basis.

As containers in test C, six earthen pots having the same top area and depth (16.5 cm. deep and 16 cm. in diameter) were selected. All the pots were filled with equal amounts of ordinary garden soil. The first two pots were planted to tobacco seedlings and served as control. On the surface of the soil contained in the other two pots, volcanic ash as thick as two and one-half centimeters (750 gms.) was placed. The medium was moistened and later planted to tobacco. On the surface of the soil in the remaining two pots two and one-half centimeters of volcanic ash was also placed, but the volcanic ash was thoroughly mixed with the garden soil. The medium was then also moistened with water and planted to tobacco. All the six pot cultures were placed outside the greenhouse, and whenever the plants needed water all the cultures were watered uniformly.

RESULTS

The results of the experiment are presented in tabulated form and grouped into two, namely, the chemical composition of the volcanic ash and the ordinary garden soil on one hand, and plant response on the other.

Chemical composition of medium.—Table 2 shows the chemical composition of the fine ejecta of Mayon Volcano. The results of the analyses of Dr. N. L. Galvez of the College of Agriculture, University of the Philippines were tabulated with the results of analyses of the Bureau of Science, Manila, for comparison. Also the amount of nitrogen, phosphorus and potassium present in the ordinary garden soil was given.

Table 3 shows the computed amount of nitrogen, phosphorus, and potassium present in every pot culture. These figures were obtained from the results of the analyses presented in table 2.

Plant response.—The results of the three test cultures conducted are presented in tables 4, 5, and 6. Table 4 shows the effect of varying percentages of volcanic ash upon the growth of tobacco plants grown in pots placed under greenhouse conditions during the months of September and October, 1938. Another

set of data gathered during the months of February and March, 1939 is presented in table 5. Table 6 shows the results of test C conducted during the months of November and December, 1939.

DISCUSSION OF RESULTS

The ash ejected by Mayon Volcano (table 2) contained the major essential food elements necessary for normal growth of green plants. These are potassium, calcium, magnesium, phosphorus, sulphur, and nitrogen. Also, some of the trace elements needed for plant growth such as iron and manganese were present. The constituent of the volcanic ash that was present in the highest amount was SiO_2, being 56.65 per cent. This was followed in the descending order by Al_2O_3, CaO, Fe_2O_3, FeO, MgO, Na_2O, K_2O, P_2O_5, SO_3, MnO, N, and S. The substances found were practically the same in kind and quantity as those reported by Galvez (table 2) except that in his report nitrogen was absent[5].

TABLE 2.—*Analyses of the fine ejecta of Mayon and Taal volcanoes and ordinary garden soil.*

Constituents	Mayon Volcano (a)	Mayon Volcano (b)	Taal volcano ash [c]	Ordinary garden soil [d]
	Per cent	*Per cent*	*Per cent*	*Per cent*
SiO_2	56.65	56.36	50.79	
FeO	3.31		5.77	
Fe_2O_3	3.66	[e] 8.33	3.20	
Al_2O_3	20.30	19.37	16.17	
CaO	7.18	8.50	7.70	
MgO	3.07	1.13	2.87	
SO_3	.14	.40	10.53	
S	Nil		.50	
P_2O_5	.44	.56	.06	.24
K_2O	.50	1.16		.79
Na_2O	1.24	2.12		
N	.01			.10
MnO	.13			
Mn_3O_4		.44	Trace	

[a] Volcanic ash, pH, 5.2; [d] Garden soil, pH 6.30.
[a] Analyzed by Messrs. R. R. Oliver and J. Roco (Aug. 15, 1938) Bureau of Science, Manila.
[b] Reported by Dr. N. L. Galvez (1939), College of Agriculture.
[c] Analyzed by Cox (1911). Finest ash from upper southern slope of Taal.
[d] Analyzed by Mr. R. T. Marfori for P_2O_5, K_2O, and N only (Aug. 15, 1938).
[e] Includes FeO.

[5] The samples used in the study contained 0.01 per cent nitrogen. If nitrogen is really wanting in volcanic ash, its presence in the sample is attributed to be due to some organic dirt collected together with the volcanic ash.

Volcanic ash is not toxic to tobacco plant.—Tobacco being a leaf crop, the height of stem was not considered a good criterion for the study of the effect of the volcanic ash upon the growth of the tobacco plant for obvious reasons. The total leaf area (leaf product) and dry weight of leaves were used instead. The results of test A (tables 4 and 5) show that the control plants grown in garden soil only had the biggest leaf product and heaviest dry weight of leaves. The plants grown in volcanic ash were the smallest and those grown in soil with volcanic ash of varying percentages were intermediate. It was also observed that the higher the percentage of volcanic ash in the culture medium, the poorer was the growth of the plant and also the lighter the total air-dry weight of the leaves of one plant. No sign of aluminum toxicity was observed although volcanic ash analyses contained 20.30 per cent Al_2O_3. It is very apparent that this metal was not rendered soluble or the toxic effect of active aluminum (if present) in the culture medium upon the tobacco plant was inhibited or prevented by the presence of sufficient amount of CaO and P_2O_5 in the soil medium. For, according to Hartwell and Pember (2, 3) the practical advantage of phosphating and liming soil lies in the precipitation of active Al. Volcanic ash contained 7.18 and 0.44 per cent CaO and P_2O_5, respectively.

TABLE 3.—*Computed amount of N, P_2O_5 and K_2O in every pot culture of tests A and B based on results of analyses as reported in table 2.*

Culture media per cent mixture	Nitrogen (N)			Phosphorus (P_2O_5)			Potassium (K_2O)		
	Garden soil	Volcanic ash	Total	Garden soil	Volcanic ash	Total	Garden soil	Volcanic ash	Total
	gm.	*gm.*	*gm.*	*gm.*	*gm.*	*gm.*	*gm.*	*gm.*	*gm.*
[a]	8.00		8.00	19.20		19.20	63.20		63.20
5	7.60	.04	7.64	18.24	1.76	20.00	60.04	2.00	62.04
10	7.20	.08	7.28	17.28	3.52	20.80	56.88	4.00	60.88
20	6.40	.16	6.56	15.36	7.02	22.38	50.56	8.00	58.56
30	5.60	.24	5.84	13.44	10.54	23.98	44.24	12.00	56.24
40	4.80	.32	5.12	11.52	14.08	25.60	37.92	16.00	53.92
50	4.00	.40	4.40	9.60	17.60	27.20	31.60	20.00	51.60
[b]		.80	.80		35.16	35.16		40.00	40.00

[a] Garden soil, control. [b] Volcanic ash.

The downward trend of growth of the volcanic ash-treated plants showing a direct relation to an increase in the percentage of volcanic ash in the soil mixture (plates 1 and 3) was attributed to be mainly due to the decreasing effect of the total

TABLE 4.—*Effect of volcanic ash upon the growth of tobacco plants grown in pots under greenhouse condition (first trial).*

Culture media per cent mixture	Average height		Average total leaf product		Average dry weight of leaves		Average measurements of biggest leaf of 2 plants				Description of plant at end of culture
							Test A		Test B		
	Test A	Test B	Test A	Test B	Test A	Test B	Length	Width	Length	Width	
	cm.	*cm.*	*sq. cm.*	*sq. cm.*	*gm.*	*gm.*	*cm.*	*cm.*	*cm.*	*cm.*	
([a])	66.0	80.5	1,302.5	1,325.5	4.5	4.8	19.5	9.5	21.5	9.8	Test A. Growth, poor. Leaves, pale green. Plants slender. Test B. Growth, poor. Leaves, pale green. Plants slender.
5	60.5	90.0	1,287.9	1,472.9	4.5	5.8	19.5	9.1	22.0	10.5	Do.
10	52.5	94.0	1,157.5	1,429.4	4.0	5.1	19.0	9.0	21.0	10.0	Do.
20	59.5	87.0	1,048.1	1,271.2	3.5	4.3	19.0	9.0	21.0	9.8	Do.
30	56.1	85.0	878.4	1,184.3	3.0	4.1	17.0	7.8	20.5	9.0	Do.
40	46.5	88.5	806.0	1,078.9	2.8	3.7	15.5	6.9	19.3	8.8	Test A. Growth, very poor. Leaves yellowish. Plants slender. Test B. Growth, very poor. Leaves, yellowish. Plants, slender.
50	46.0	95.9	721.5	1,005.4	2.5	3.5	12.5	5.8	18.0	8.0	Do.
([b])	30.0	60.5	567.0	833.8	1.9	2.5	10.0	4.9	16.5	7.0	Test A. Growth, stunted. Leaves, chlorotic. Plants slender. Test B. Growth, stunted. Leaves, chlorotic. Plants slender.

[a] Ordinary garden soil, control.
[b] Volcanic ash.

amount of nitrogen and potassium in the culture medium. Table 3 shows that as the percentage of volcanic ash was increased in the soil mixture there was a gradual decrease in the total amount of nitrogen and potassium in the medium. This was due to the removal of some of the garden soil and its replacement with an equal weight of volcanic ash, the former being richer in nitrogen and potassium than the latter.

The set of cultures in test B which was prepared in the same manner as that of test A except for the method by which the plants were supplied with water (described under preparation and conduction of pot culture) exhibited growth behaviour quite different from that of test A (plates 2 and 4). In test B, the plants grown in the 5-per-cent mixture produced the biggest total leaf product and heaviest dry weight of leaves (tables 4 and 5). Those in the 10-per-cent mixture were a close second and the control plants (grown in garden soil only) were third, then followed in descending order by those in the 20–, 30–, 40–, 50– and 100–per-cent mixtures. In test A, the control plants (grown in garden soil only) were the best, then followed in descending order as the percentage of volcanic ash was increased gradually in the medium. The growth behavior of the tobacco plants in the 5- and 10-per-cent mixtures of test B is interpreted as the influence of the varying amount of soil mixture present in the culture medium caused by the method employed of watering the tobacco plants instead of the decreasing effect of the total nitrogen and potassium in the medium observed in test A. The percentages of soil moisture content of the different culture media used in test B at the termination of the experiment were found as follows: control (garden soil), 33.5; 5-per-cent mixture, 32.1; 10-per-cent mixture, 31.0; 20-per-cent mixture, 30; 30-per-cent mixture, 27; 40-per-cent mixture, 26.5; 50-per-cent mixture, 26.0; and 100-per-cent mixture (volcanic ash only), 24.6. Peralta and Paguirigan(8) pointed out in their previous studies that in the soil a proper balance between the amount of water and air should exist to abound among the roots of tobacco for good growth and that potted tobacco plants grew best when the range of soil moisture in sandy loam soil was between 60 and 70 per cent saturation. Apparently the addition of varying amounts of volcanic ash to garden soil affected the water-absorbing capacity of the garden soil and that the 5- or 10-per-cent mixture brought the soil structure of the medium to an optimum state of condition for water absorption most beneficial

TABLE 5.—*Effect of volcanic ash upon the growth of the tobacco plants grown in pots placed outside of the laboratory (second trial).*

Culture media per cent mixture	Average height		Average total leaf product		Average dry weight of leaves		Average measurements of biggest leaf of 2 plants				Description of plant at end of culture
							Test A		Test B		
	Test A	Test B	Test A	Test B	Test A	Test B	Length	Width	Length	Width	
	cm.	*cm.*	*sq. cm.*	*sq. cm.*	*gm.*	*gm.*	*cm.*	*cm.*	*cm.*	*cm.*	
(a)	25.0	40.7	1,368.6	1,401.2	4.4	5.0	19.0	8.5	19.5	8.6	Test A. Growth, poor. Leaves, pale green. Test B. Growth, poor. Leaves, pale green.
5	26.5	43.2	1,352.0	1,482.5	4.3	5.5	19.0	8.5	19.5	8.6	Plant, flowering.
10	22.5	45.3	1,201.0	1,452.2	4.2	5.2	18.5	8.4	19.0	8.1	Do.
20	30.5	55.8	912.1	1,385.5	3.1	5.0	18.0	8.0	18.5	8.0	Do.
30	20.0	30.5	908.3	1,002.5	3.1	3.4	17.0	7.8	17.1	8.0	Do.
40	23.5	25.4	696.9	773.6	2.4	2.6	16.2	7.2	17.0	7.5	Test A. Growth, poor. Leaves, yellowish. Test B. Growth, poor. Leaves, yellowish.
50	5.5	20.3	462.5	521.6	1.6	1.8	13.0	5.7	13.5	5.8	Do. Do.
(b)	2.0	2.3	209.5	182.7	0.7	0.6	10.2	4.4	9.5	4.6	Plants, stunted. Leaves, chlorotic.

[a] Ordinary garden soil, control.

[b] Volcanic ash.

for tobacco growth when water was supplied the plant subterraneously.

Volcanic ash is beneficial to tobacco plants as indicated by total leaf product and dry weight of leaves.—Cultures 2 and 3 of test C (table 6) contained both the ordinary garden soil and 750 grams each of volcanic ash. Culture 1 was the control and contained only garden soil. The increase in total leaf products and dry weight of leaves of the tobacco plants grown in cultures 2 and 3 to almost two times as much as those in culture 1 was due to the increase in the total amount of the N, P_2O_5 and K_2O content of the medium by 0.075, 3.3, and 3.75 grams, respectively caused by the addition of volcanic ash. Thus, it may be said that the addition of a moderate amount of the volcanic ash to ordinary garden soil improved the nutritive value of the soil beneficial to the growth of the tobacco plant (plate 5). No appreciable difference was noted between the plants grown in cultures 2 and 3, except that the plants in culture 3 had a little bigger leaf area and heavier dry weight of leaves than those in culture 2 (table 6).

TABLE 6.—*Test C showing effect of volcanic ash upon the growth of the tobacco plants grown in pots placed outside of laboratory (third trial).*

Culture No.	Kind and treatment of media used	Average height	Average total leaf product	Average dry weight of leaves	Average measurements of biggest leaf of 2 plants		Condition of plant at end of culture
					Length	Width	
		cm.	*sq. cm.*	*gm.*	*cm.*	*cm.*	
1	Ordinary garden soil (control)	6.7	295.8	1.0	12.0	6.5	Growth, poor. Leaves, pale green.
2	Ordinary garden soil and 2½ cm. thick of volcanic ash placed on the surface of the soil	11.5	509.0	1.7	14.8	7.2	Growth, better than plants in culture 1. Leaves, green.
3	The same as culture No. 2 but volcanic ash was mixed thoroughly with the soil.	11.5	607.9	2.1	14.2	7.2	Do.

SUMMARY

When Mayon Volcano erupted on June 5, 1938, some of its fine ejecta were collected two weeks after from the surface

of the galvanized-iron roofing of houses in the barrios of the municipalities of Guinobatan and Ligao, Albay. The chemical constituents of the volcanic ash were determined quantitatively and it contained the chief constituents of rocks, namely, SiO_2, Al_2O_3, Fe_2O_3, Mn_3O_4, CaO, MgO, K_2O, Na_2O, P_2O_5, and H_2O.

Although volcanic ash analyses showed a very high amount of Al_2O_3 (20.3 per cent), no sign of aluminum toxicity was observed on tobacco plants. On the other hand, the addition of a moderate quantity of volcanic ash to ordinary garden soil proved beneficial to the growth of the tobacco plant.

The usefulness of volcanic ash as a fertilizer, particularly to tobacco plants, may be increased a great deal by the addition of a nitrogen-bearing compound. Nitrogen becomes the limiting major food element in the soil if not supplied artificially.

ACKNOWLEDGMENT

The senior author wishes to express his gratitude to Mr. H. S. Silayan, Director of Plant Industry for granting the authority to make the field trip to Albay to conduct the necessary field observation on the effect of the eruption of Mayon Volcano on agricultural crops and to gather necessary materials for laboratory studies; to the Governor of the Province of Albay, and Mr. Julian C. Ilagan, acting provincial agricultural supervisor and his staff for their valuable coöperation and help in securing the necessary materials; to Mr. D. B. Paguirigan, chief, Tobacco Research Section for his encouragement during the progress of the work; and to Messrs. R. R. Oliver, T. Roco, and R. T. Marfori of the Bureau of Science, Manila, for carrying out the necessary analyses of the samples submitted.

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ILLUSTRATIONS

Plate 1

Effect upon the growth of tobacco plants of varying the percentage of volcanic ash in culture medium in pots placed under greenhouse conditions. Plants watered by pouring water on the surface of the medium (first trial, September and October, 1938).

Plate 2

Effect upon the growth of tobacco plants of varying the percentage of volcanic ash in culture medium in pots placed under greenhouse conditions. Plants watered subterraneously (first trial, September and October, 1938).

Plate 3

The same as plate 1 except that the plants were placed outside the laboratory (second trial, February and March, 1939).

Plate 4

The same as plate 2 except that the plants were placed outside the laboratory (second trial, February and March, 1939).

Plate 5

Effect upon the growth of tobacco plants of adding volcanic ash to an equal weight of ordinary garden soil.

FIG. 1. Garden soil alone.
2. Garden soil and 2½ cm. thick of volcanic ash placed on the surface of the soil.
3. Garden soil and 2½ cm. thick of volcanic ash mixed thoroughly with the soil.

Text Figure 1.

A portion of the map of the Province of Albay showing the extent of destruction to agronomical crops two weeks after the eruption of Mayon Volcano on June 5, 1938.

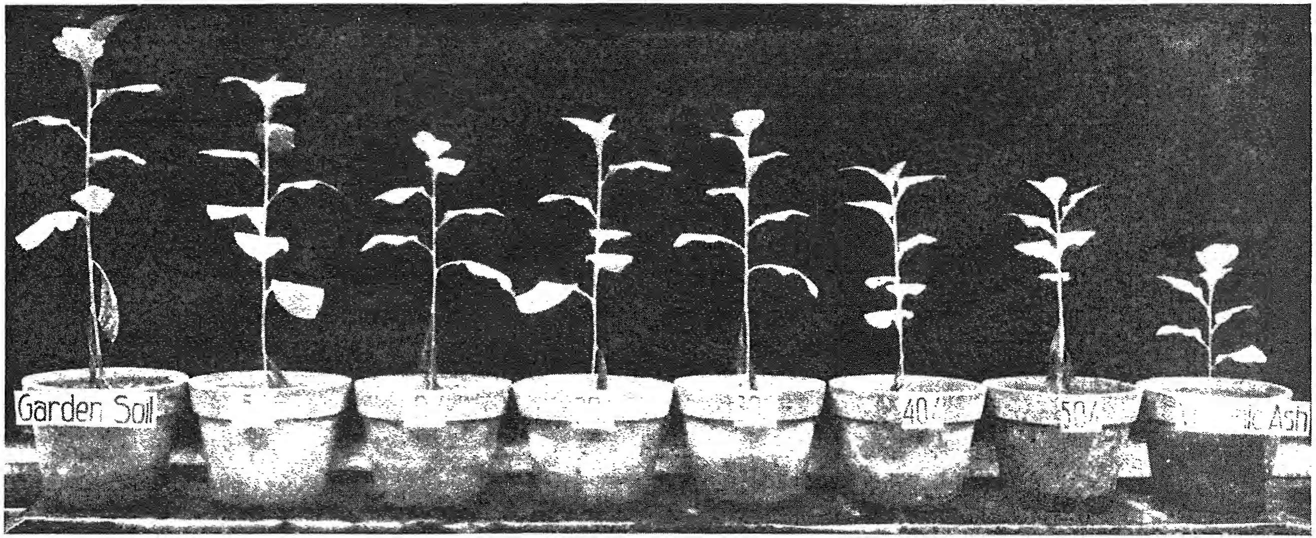

PLATE 1.

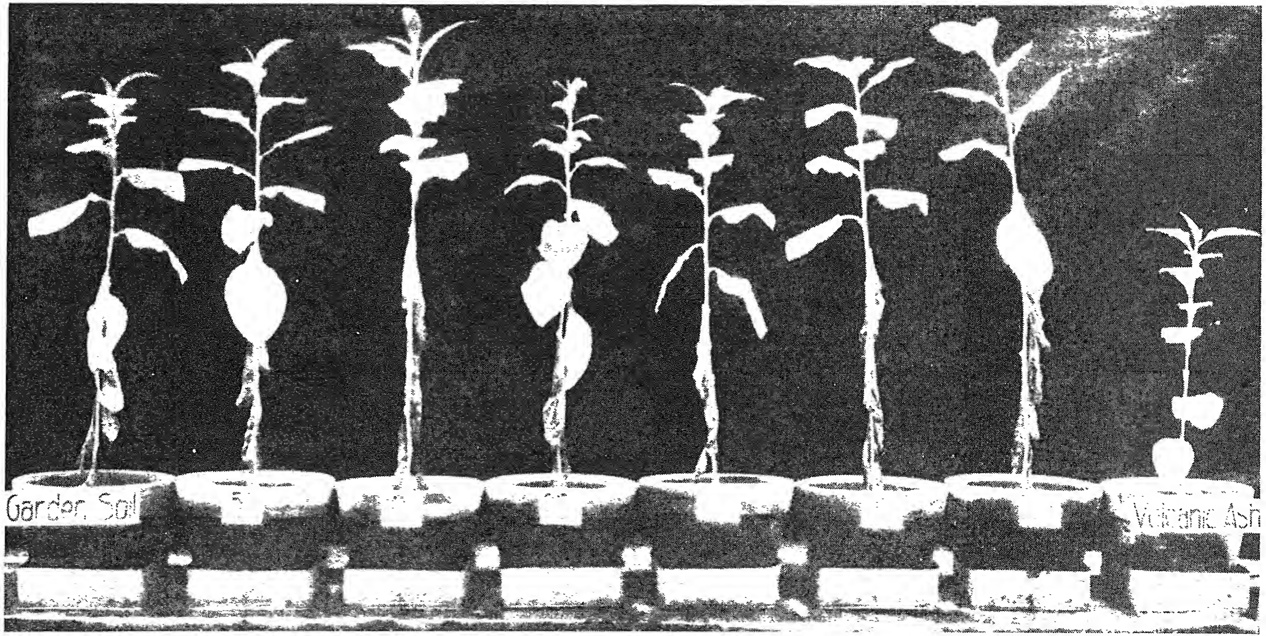

PLATE 2.

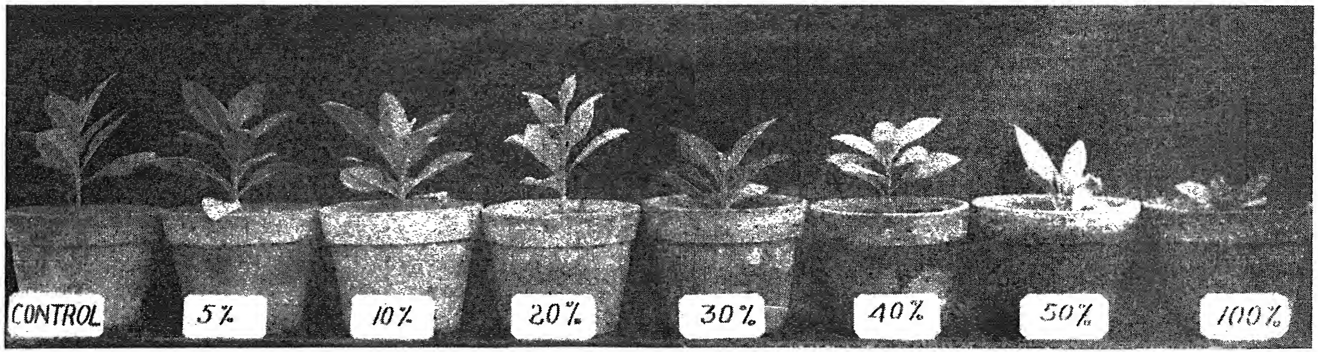

PLATE 3.

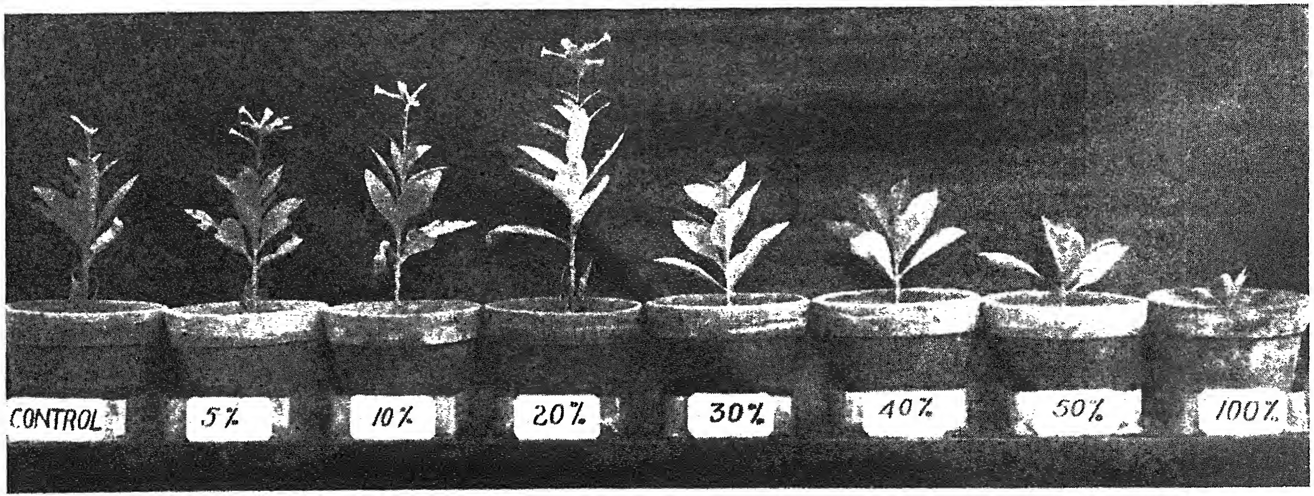

PLATE 4.

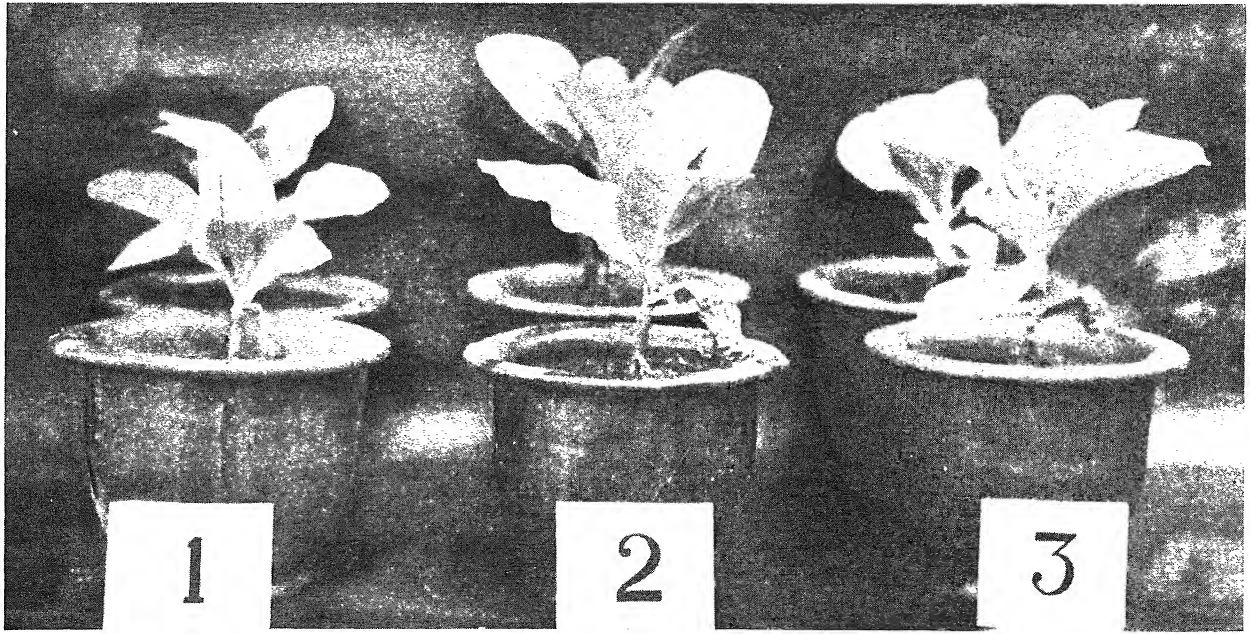

PLATE 5.

VARIETAL SUSCEPTIBILITY OF PEANUTS TO BLACK SPOT (CERCOSPORA PERSONATA (B. & C.) Ell. & Ev.)[1]

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Of the Bureau of Plant Industry, Manila

FIVE PLATES AND ONE TEXT FIGURE

The black spot caused by *Cercospora personata* (B. & C.) Ell. & Ev. is one of the most destructive fungus diseases of the peanut (*Arachis hypogaea* Linn.) in the Philippines. It is present wherever peanut is grown, and on account of conspicuity, this disease is generally considered a leaf spot disease, but in reality it attacks also the leaf petioles, stipules, vines, and pegs. Owing to its persistent nature, it occurs frequently in epidemic proportions occasioning severe defoliation, especially during damp weather. Although this disease is generally considered of little economic importance and no attempt has ever been made to evaluate its destructive effects, since commercial growers seem either unconcerned or unaware of its presence, there seems little doubt that the black spot on the leaf alone causes considerable weakening of the affected plants. Aside from the premature shedding of the leaves and petioles induced by the black spot infection, that produced on the main stem and subsidiary vines of the affected plants causes them to become brittle on approaching maturity, and some lead to eventual death. The surviving plants look spindly and the remaining leaves at the top become abnormally small or degenerated due to interruptions in the normal physiological function. On account of the early infection period of the disease, appearing generally a month and a half after planting under field conditions, lasting until harvest time, and the probable aftereffects of the disease, such as possible reduction in yield of fruits and straw, and predisposition to other maladies, some means should be found whereby its ravaging effects could be reduced to the minimum. The future of the peanut as a money crop would seem to hinge largely on the almost total absence of destructive maladies. The black leaf spot alone is mentioned in the literature (9) from all important peanut-growing countries of the world.

Distinct differences in behavior of varieties towards the black spot disease have been observed previously. The object, there-

[1] Received for publication September 9, 1940.

fore, of this investigation is to determine as much as possible the relative susceptibility of peanut varieties to the disease by a method approaching the nearest precision, with the aim of providing data which might be of value to peanut growers and others interested.

HISTORICAL REVIEW

GEOGRAPHICAL DISTRIBUTION AND IMPORTANCE OF THE DISEASE

Judging from the experience of other countries, together with observations made in the Philippines, it may be said that the black spot, caused by *Cercospora personata* (B. & C.) Ell. & Ev.(9), is capable of causing considerable damage. Reinking(4) states that this leaf spot is widely distributed in the Philippines and may become very destructive to some varieties of peanut. In India, where the disease is locally known as "tikka," Butler(3) reports that its prevalence in very severe form was the principal cause of the diminishing yield in groundnut. In Java, as cited by the same author(2), this disease has often wiped out large tracts of groundnut. Butler(2) also cited that the same disease has been commonly seen in German East Africa, Ceylon, and probably in many parts of Asia and Africa wherever peanut is grown. In the United States, Beattie and Beattie(1) report that the black leaf spot of peanut causes appreciable losses. The same disease is also known in China, Japan, and Italy(9) and in the West Indies, Surinam, Paraguay, the Congo, Malaya, and Australia(3).

Wolf(8) made an attempt to correlate the leaf spot of peanut caused by *Cercospora personata* (B. & C.) Ell. & Ev. with yield. This author found out that the leaf spot alone could cause a reduction of 35.07 per cent in active leaf area and an approximate loss in yields of from 5 to 20 per cent was regarded as reasonable.

A thorough survey of the literature and the description of the disease in detail will be dispensed with. Reference to past work will be made here and there in this paper as necessity arises. Mention, however, may be made of a previous and recent work on this disease in the Philippines by Roldan and Querijero(7), which deals mainly with the symptomatology, etiology, epidemiology, and control of the disease. This is the only available paper which has a special bearing on the present work. Their experiments conducted in the College of Agriculture at Los Baños, Laguna, Philippines, with eight varieties of

peanuts showed that all reacted to the black spot in practically the same way, the range of susceptibility being 79.96 ± 2.20 (78.76 ± 2.20) per cent in Santo Tomas to 87.34 ± 2.02 (87.33 ± 2.02) per cent in Valencia variety. The authors concluded that there was no significant difference in the reaction of the eight varieties used to black spot disease.

FIELD OBSERVATIONS

PREVALENCE OF THE DISEASE AND REACTION OF VARIETIES

In view of the prevalence of the black spot disease observed by the senior author in the Central Experiment Station and elsewhere in 1934 and 1935, it was noted that some variation in susceptibility was exhibited, being more destructive in some varieties than in others. A problem, therefore, presented itself as to whether or not a certain degree of resistance would be observed to warrant the planting of fairly high-yielding varieties that can appreciably resist the disease as a control measure.

Ocular examinations of the plat cultures of the Plant Breeding Section, Bureau of Plant Industry, Manila revealed in some way the degree of infection of the peanut varieties with the black spot. The difference in degree of susceptibility was so marked that it could hardly fail to attract attention. Taken at certain intervals, a résumé of these observations showed the following comparative reactions:

TABLE 1.—*Observation on the reaction of some peanut varieties to the black spot during the years 1934–1935.*

Variety name	Degree of infection	Variety name	Degree of infection
Macapno	Very severe.	Singapore	Moderate.
Cagayan	Severe.	North Carolina	Moderate.
Spanish	Severe.	Tirik	Moderate.
White Improved Spanish	Severe.	Valencia	Moderate.
Biit	Moderate.	Vigan Lupog	Moderate.
Georgia Red	Moderate.	Virginia Jumbo ([a])	Slight.
Mongoyai	Moderate.	Tai-tau	Slight.
San José	Moderate.	Virginia Jumbo	Resistant.

As shown in table 1, none of the varieties observed was found completely free from black spot infection. The variation in degree of black spot attack was quite evident, ranging from some resistance or slight infection to very severe infection, based largely upon density of spottings and degree of defoliation sustained. Four varieties led by Macapno showed severe in-

fection; nine had moderate infection; while three, all runner varieties, showed only slight susceptibility.

DEFOLIATION DUE TO BLACK SPOT INFECTION

At the early period of infection of the plants, it seems not improbable that a certain degree of incipient damage may have occurred as a direct result of the curtailment in the rate of photosynthesis of an active leaf area. The falling off of the leaves due to the black spot infection (plate 1) takes place in progression (as a gradual process), starting from the lower leaves close to the ground and so on in succession towards the top. The manner by which the shedding off of the leaves occurs was observed as follows: the first pair of pinnae, close to the stem, drops off first, simultaneously or one pinna after the other, leaving the slender leaf petiole intact. Later, the second pair of pinnae at the tip of the petiole follows. This defoliation goes on gradually upwards until the affected vine is nearly or entirely stripped of its foliage. In severe cases of infection, almost the entire frond may drop off in rapid succession. This premature shedding of leaves and subsequent weakening vitality of the affected plants are believed to have some relation with the productive capacity of the plant and the question cropped up as to whether or not it may ultimately have disastrous effect on yield. As an instance of this, some defoliated plants gave little yield whereas in some plants or in some varieties defoliation resulted in death.

INFECTION OF VINES AND PEGS

Aside from the black spot affections involving the aërial parts, such as leaves, leaf petioles (plate 2), and stipules, the infection of vines and pegs causes serious handicaps in the normal functioning of the plant and distribution of food materials. The gynophores having typical stem structures, if they get infected, especially at an early stage, sustain as much adverse effects as those received by the genuine stems (plate 3), because of continuity of vehicular activity, and the passage of food materials is virtually hampered by destruction or malformation of necrotic tissues. The root system being that of the tap root type, the aërial portions are also subject to black spot infection. Much more serious perhaps in effect of all black spot infections is that produced on the pegs (plate 4) as it directly obstructs the conveyance of elaborated food needed in the normal develop-

ment of the underground parts, the pods especially, which are of material value from the agricultural aspect. The infection of some of the pegs, therefore, could cause irregular maturity of the pods; many of them having been observed to be relatively small, generally one-seeded and immature.

POSSIBILITY OF CONTROL BY VARIETAL RESISTANCE

To the knowledge of the writers, very little attention has ever been paid towards the control of peanut black spot in the Philippines. From the results of experiments obtained in the Philippines, Roldan and Querijero(7) stated in unmistakable terms that "the control of the disease is a difficult matter." In their paper they presented an observation on black spot infection of eight varieties of peanut at the College of Agriculture, Los Baños, Laguna, and concluded that all the varieties tested showed practically the same degree of susceptibility. In view of the lack of information on the method of controlling this disease which prevails everywhere from season to season or year after year, this paper is now presented with the hope that it would be of some practical value to the farmers.

Judging from available foreign literature, there seems to be no known feasible method of control recommendable for the black spot disease of peanut. Wolf(8), and Roldan *et al.*(7) state that seed disinfection and crop rotation are impracticable because the disease is claimed to be not seed-borne; that the black spot organism persists on peanut refuse or decaying or dead leaves scattered in the soil from season to season; and that the spores can be readily spread from field to field by air currents and certain insects, especially those that feed on diseased leaves, and by other mechanical agencies. Considering the previous results, as a rational control measure, the writers believe that the infected fields should better be not planted to peanuts in succession. In a much earlier work than that of Roldan *et al.*(7), Wolf(8) had demonstrated clearly the inefficacy of rotation as a method of control for the same disease. Butler's work(2) in India showed that spraying with Bordeaux mixture was not satisfactory because the aërial portions of the fungus were developed on the nether surface of the leaves and were thus difficult to contact with the fungicide. From the above considerations, it seems now clear that the only possible panacea for this peanut malady is the planting of varieties that can withstand the devastating effects of the disease.

MATERIALS AND METHODS

In order to determine the behavior of varieties to the black spot, 100 plants each of 13 varieties were planted in two replications in heavily infested plats, measuring 1 meter x 5 meters, provided with a half meter dead space, and the seeds were planted 30 centimeters in the row and 40 centimeters between rows. To estimate the degree of infection to the nearest precision, actual counts of the leaf spottings were made per unit area ($\frac{3}{4}$ inch square) of leaf surface taken at three definite, fortnightly intervals, covering a period from early infection or when all varieties showed appreciable black spot infection to the peak of greatest susceptibility. The last 2 readings were made from 40 different leaves of all stages, that is, young, middle age, and mature, while in the first only 32 leaves were used, selected at random from the peanut plants where not a single individual showed complete freedom from the disease, and the spots were recorded with the aid of a mechanical hand tally counter. The use of different stages of leaves from different uniformly mature plants was necessary so as to include all the active leaf area engaged in photosynthetic activity.

RESULTS

The results of this study are given in table 2.

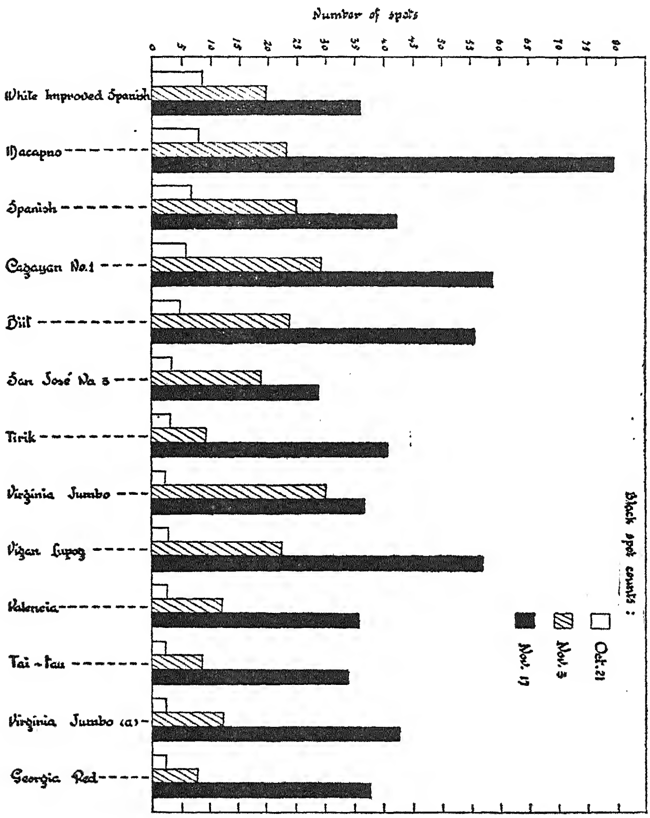
TABLE 2.—*Black leaf spot counts on thirteen peanut varieties taken at three intervals of time.*

Variety of peanut	Number of spots			
	Oct. 21 [a]	Nov. 3 [b]	Nov. 17 [b]	Average of three counts
White Improved Spanish	8.68	19.70	35.92	21.45
Macapno	8.09	23.32	79.50	36.97
Spanish	6.71	24.77	42.20	24.56
Cagayan No. 1	5.75	29.20	58.87	31.27
Biit	4.78	23.85	55.62	28.08
San José No. 3	3.34	18.70	28.72	16.92
Tirik	3.21	9.37	40.55	17.71
Virginia Jumbo	2.46	30.00	36.65	23.03
Vigan Lupog	2.93	22.42	56.90	27.41
Valencia	2.68	12.05	35.65	16.76
Tai-tau	2.28	8.60	33.82	14.92
Virginia Jumbo (•)	2.31	12.35	43.62	19.42
Georgia Red	2.31	7.75	37.67	15.91

[a] Average of 32 readings. [b] Average of 40 readings.

From the preceding data it can be readily seen that the degree of infection increases as the sources of natural inoculum in-

crease in proportion, and in all cases the rate of infection is in progression. The height of greatest susceptibility becomes more apparent during the senescent period of growth, when the plant uses most of its resources in the development of the pods. That all varieties under study were susceptible to the black spot infection is a foregone conclusion; but that varieties differ in susceptibility to the disease seems also clear after a preliminary observation. The writers, however, believe that it would require



Text figure 1.—Graphic representation of the fortnightly counts of the black spot (*Cercospora personata* (B. & C.) Ell. & Ev.) on the leaves of thirteen varieties.)

a large number of cultures, following the same method of study conducted in from three to five seasons before we can fully appreciate their worth.

In determining the degree of susceptibility, however, the averages of the three fortnightly counts were made and these show the rank of susceptibility in the following descending order: Macapno, Cagayan No. 1, Biit, Vigan Lupog, Spanish,

Virginia Jumbo, White Improved Spanish, Virginia Jumbo(a), Tirik, San José No. 3, Valencia, Georgia Red, and Tai-tau.

In the first counts made on October 21, 1936 (fig. 1), of black spots on the leaves, all the thirteen varieties showed susceptibility in a more or less uniform degree; White Improved Spanish, Macapno, Spanish, Cagayan, and Biit showing slightly more infections than the rest of the varieties studied, or about 5 to 8 black spots per $\frac{3}{4}$ inch-square of leaf area. The second fortnightly counts of the leaf spot revealed a similar range of susceptibility with rather abrupt changes in Cagayan No. 1, Biit, Virginia Jumbo, Spanish, Macapno and Vigan Lupog. In the third count, however, or during the period when the differences in susceptibility became more apparent, the extent of black spot infections ranged from 28.72 in San José No. 3 to 79.5 in Macapno. At this stage of growth increased infection was very marked on the varieties Macapno, Cagayan No. 1, Biit and Vigan Lupog. From the results of this study it seems now quite evident that four of the varieties can be classed as highly susceptible, namely, Macapno, Cagayan No. 1, Vigan Lupog, and Biit; six varieties fall in the order of moderate susceptibility; while two may be considered resistant varieties, viz., San José No. 3 and Tai-tau. This appraisement seems to deviate but slightly from the computed averages. In a three-year work on peanut(5) conducted by the senior author, Tai-tau was one of the runner varieties which was found to have consistently shown considerable resistance to black spot infection besides being a high yielder.

ECONOMIC EFFECT OF THE DISEASE

The economic importance of the black spot disease cannot be appreciated until after 2 to 3 plantings have been made continuously in the same field not previously grown to peanut. Although this disease has been observed to cause severe defoliation and spindling in some varieties, and deterioration of nut was manifest, largely by virtue of the food supply having been partially cut off through the infection of vines and pegs, no exact figures could be given to substantiate the claim. The lack of adequate relative expression might be explained by the fact that the deferred death of the plants due to black spot infection occurred generally at the senescent period, so that no substantial positive effect would result therefrom after the pods have already formed and are only awaiting the period of maturation.

An evaluation, however, of the bad effects of the disease was adequately explained by Butler(3) in the following paragraph:

> Naturally, when the attack begins early, the plant is unable to mature its nuts. Those that have begun to form as the attack reaches its height, cease development, and at harvest are found shrivelled and loose in the shell. If they have reached a certain stage of maturity before the disease becomes severe, the reduction of the total yield of nuts is less marked, as the loss of leaf occurs too late to check their development. In many cases, however, losses of from one-third to one-half have occurred in infected fields.

That the decline of groundnut production in the Bombay Presidency, as reported by Butler(2), seemed to be due to the disastrous effects of the black spot disease is supported by the fact that the incidence of "tikka" disease, caused by *Cercospora personata*, "was at its height when the exports from Bombay were at their lowest figure, and that the recovery has coincided with the disappearance of the disease."

In Senegal, an overseas possession of France in West Africa, Roger(6) states that, because of humid conditions, the peanuts that were introduced from Nigeria became very susceptible to black spot and as a result they had to be destroyed, yielding no crop at all.

The black spot produced on the vines has also a detrimental effect for it hastens maturity and renders the vines brittle, thus making them unsuitable or unpalatable perhaps for animal feed.

SUMMARY AND CONCLUSIONS

1. The black spot of peanut is an omnipresent disease of this valuable crop. The causal fungus, *Cercospora personata* (B. & C.) Ell. & Ev., is an obligate parasite and has not been observed to occur here on other host plants.

2. Its incidence on the leaf, leaf petiole, stipule, and stem has been reported by previous investigators. Through diligent search, the black spot disease was also found to infect the pegs, another vital organ of the peanut plant heretofore unknown to the writers.

3. Certain varieties of peanut show a marked difference in resistance. Black spot counts on the leaf revealed that they differ among varieties, ranging from 2.28 per $\frac{3}{4}$ inch square, at the initial infection period, to 33.82 for the same leaf area, at the time of greatest prevalence, in Tai-tau; and 8.09 to 79.50 in Macapno. The method of study here developed seems to be

sufficiently explicit in determining with good approximation the grades of black spot infection.

4. It was determined from this study that the varieties Taitau, Georgia Red, Valencia, San José No. 3, and Tirik exhibited better resistance to black spot than the other varieties in the order named. The practical side of this paper would be to show in concrete terms to the growers the damage caused through the planting of susceptible varieties in infested localities. The continuous or inadvertent planting of ill-adapted varieties that are very susceptible to the disease will in some way or another cause losses.

5. The black spot materially reduces the healthy leaf area before the pods are fully developed. The attack on the stem and peg has a much more serious influence upon the crop than the leaf spot. Although the affected plants very rarely die, they are as a rule very much weakened under field conditions.

6. Without being optimistic in the least, it seems quite probable that by the introduction and acclimatization of exotic sorts or by breeding and selection, varieties or strains possessing desirable economic traits that could resist the ravages of the disease would eventually be evolved which would contribute some efficiency and economy in our method of control. The differences in reaction observed afford a sufficient basis on which to evolve a higher degree of resistance.

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ILLUSTRATIONS

(Photographs by the Photographic Studio, Bureau of Science, Manila)

PLATE 1

Black spot of peanut caused by *Cercospora personata* (B. & C.) Ell. & Ev. on the leaves of Spanish variety; upper and lower surfaces. Approximately x 0.9.

PLATE 2

Peanut leaf petioles and vines showing black spot affection (*Cercospora personata* (B. & C.) Ell. & Ev.). Note the elliptical spots on the petioles (*a*), × 1.2, and on the stipules(*b*) and main stems(*c*), about × 2.

PLATE 3

Peanut vines and tap roots affected by the black spot (A). Note the tufts of conidiophores on the stems (B) and elsewhere. Approximately × 2.

PLATE 4

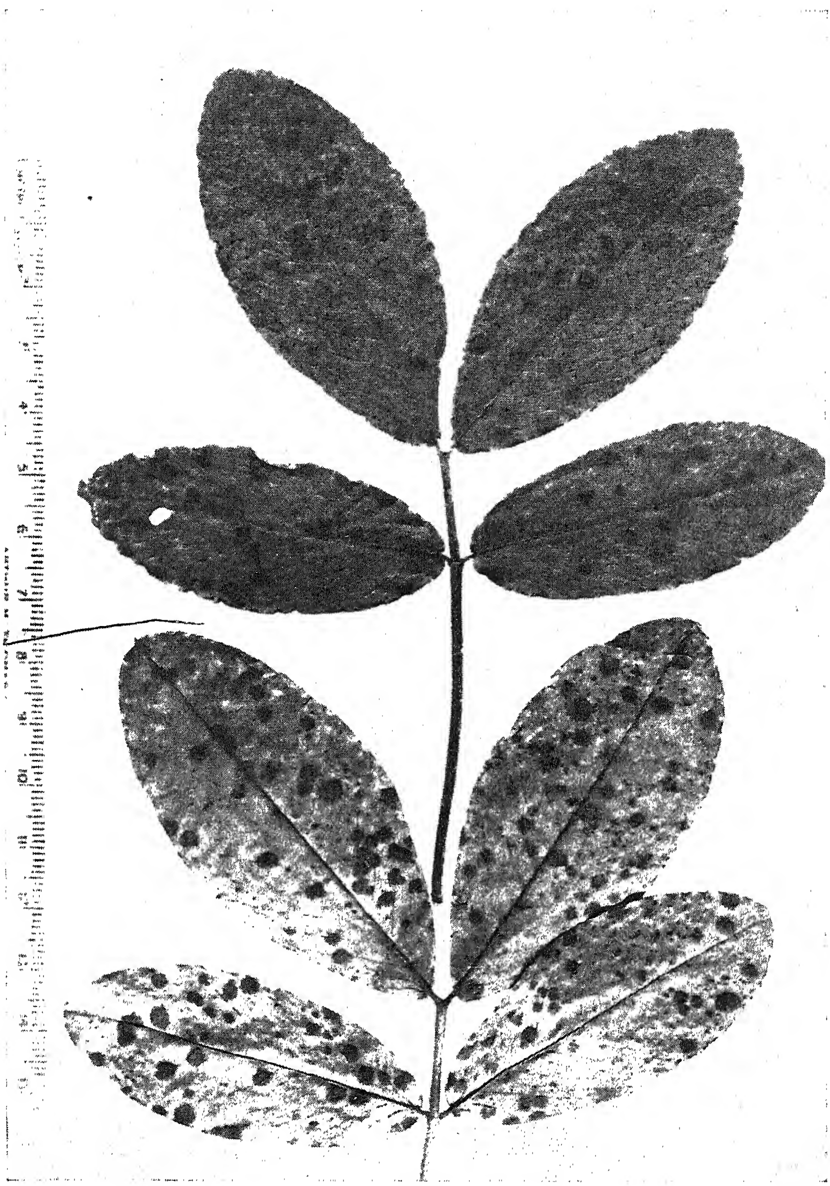
Pegs of peanut showing the black spot on various parts pointed by arrows, appearing more distinctly in the photograph at X. Approximately × 1.45.

PLATE 5

Portions of vines, and pegs of peanut attacked by the black spot, showing pods which have been probably arrested in development by infection. Arrows show probable origin by contact, and the braces show black spot infections. Approximately × 1.1.

TEXT FIGURE 1.

Graphic representation of the fortnightly counts of the black spot (*Cercospora personata* (B. & C.) Ell. & Ev.) on the leaves of thirteen varieties.



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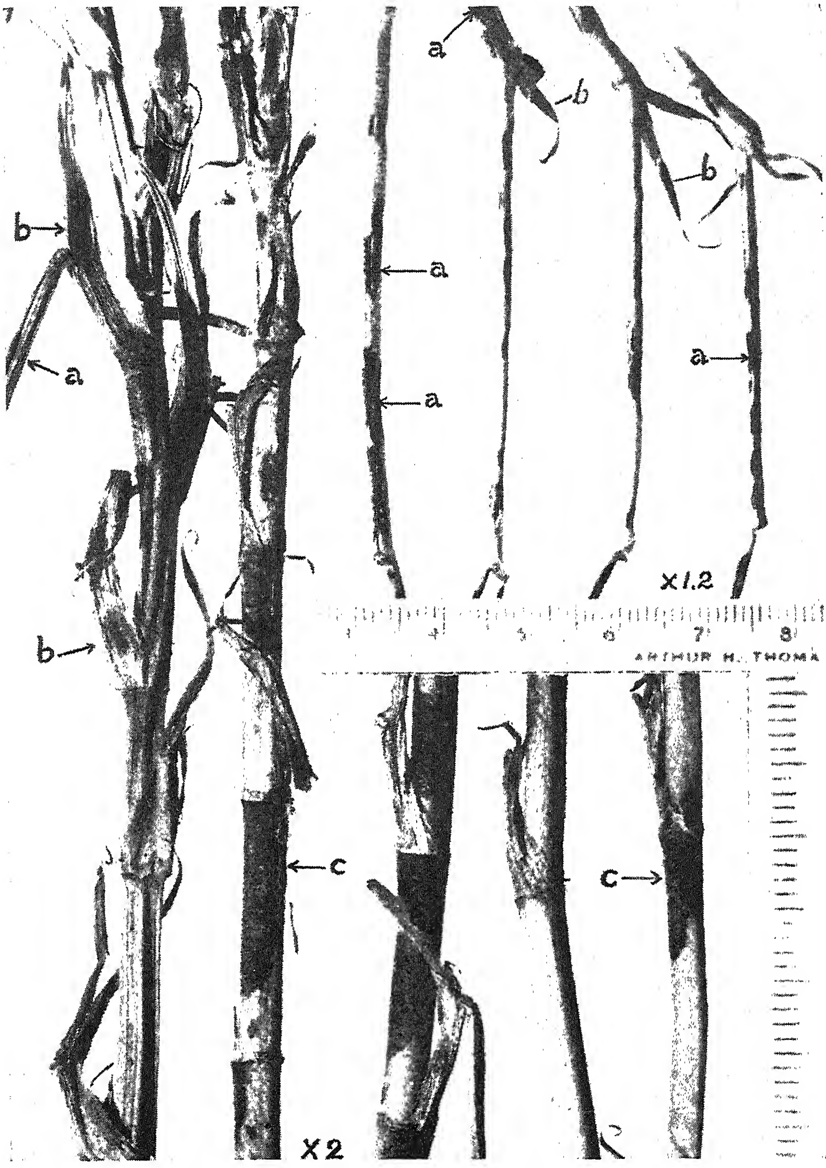


PLATE 2.

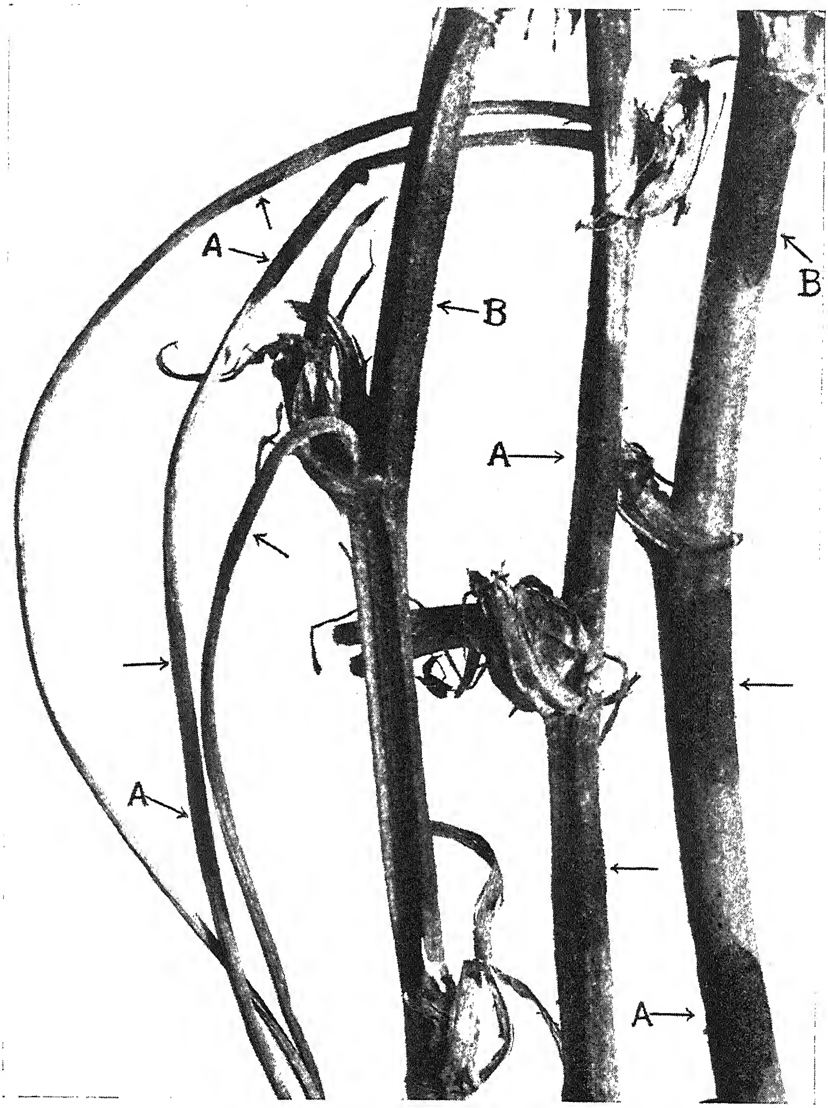


PLATE 3.

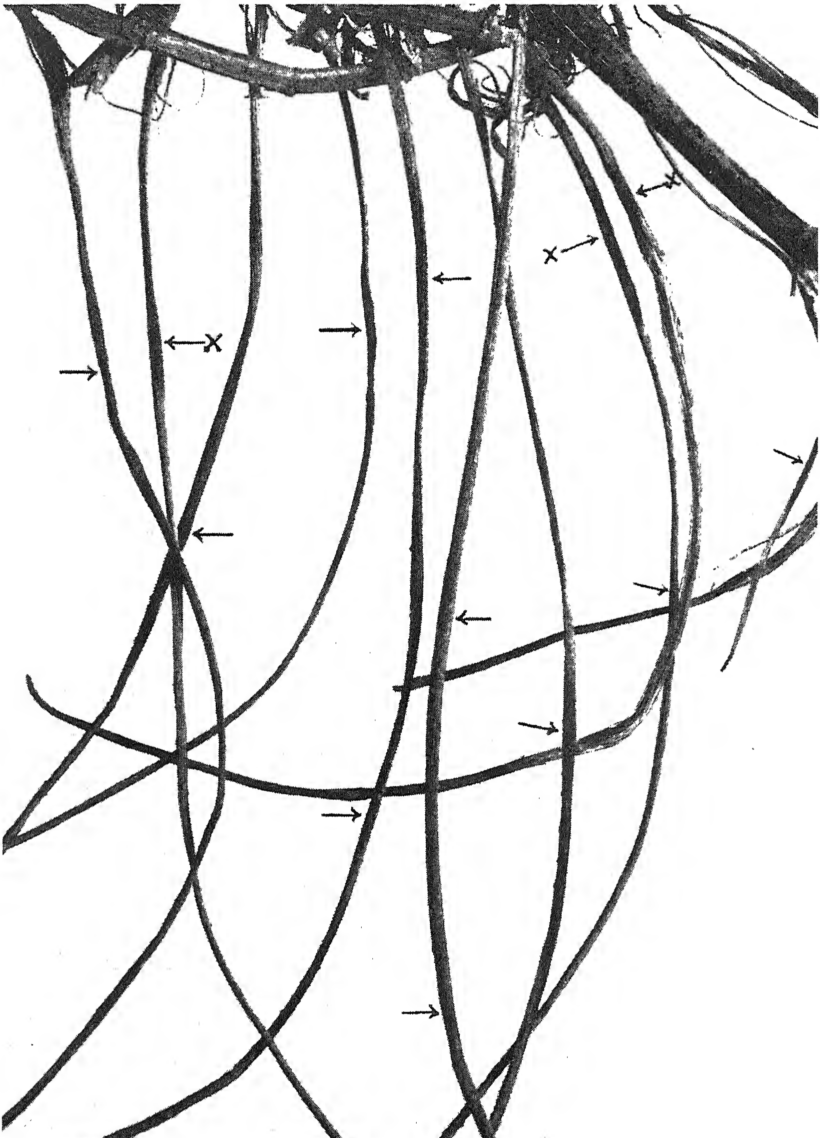


PLATE 4.

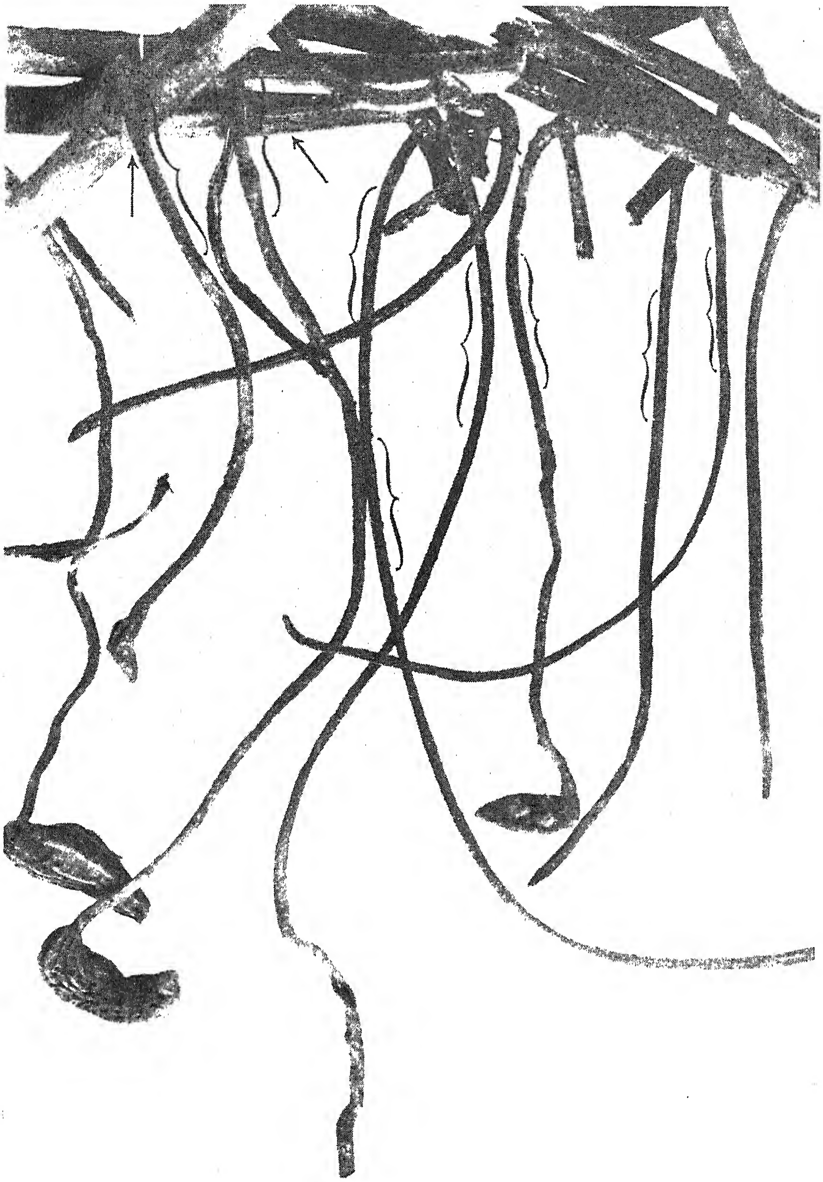


PLATE 5.

STORING SOME VEGETABLE SEEDS [1]

By P. A. RODRIGO and ALFONSO L. TECSON
Of the Horticulture Section, Bureau of Plant Industry

FIVE TEXT FIGURES

With the increasing interest in the growing of vegetables, it has also become more apparent that success in their culture is greatly predicated upon good and viable seeds. Unfortunately, however, the temperature and moisture conditions in the Philippines, practically throughout the year, are conducive to rapid deterioration of seeds. Experience bears the fact that vegetable seeds especially those imported from temperate countries lose their viability very rapidly. If there is any complaint against any local seed house, it is invariably because of the fact that in general the seeds it handles have poor germination. This is due, in almost all cases, to defective storing. Any study therefore that may throw some practical information on the proper storing of vegetable seeds should be of great value to vegetable growers as well as to seed houses and scientific workers.

Following the lead pointed out by Vibar and Rodrigo (10) in their studies on the storing of farm crop seeds, it was the object of the present study to determine the practicability and efficacy of storing vegetable seeds in air-tight containers. Heretofore, the Plant Propagation Division of the Bureau of Plant Industry had been keeping its seeds for distribution to the public in cold storage. While this method may be effective, it is not within the reach of the farming public. The method used in this study is simple yet practical and can be used easily on the farm. The study was undertaken in the laboratory of the Horticulture Section, Bureau of Plant Industry, Manila from June, 1935 to November, 1938.

REVIEW OF LITERATURE

Numerous papers dealing either directly or indirectly with seed biology and seed storage have been published. Most of the experiments, however, have been worked out in temperate countries and only a comparatively few in the tropics. It is

[1] Received for publication June 26, 1940.

not attempted here, however, to make an exhaustive review of these works but only to cite some of those that have direct bearing on the present study.

As early as 1904 Duvel(1 and 2) reported that in his studies on the storage of sweet corn, onion, cabbage, radish, carrot, pea, bean, watermelon, and lettuce seeds, he found that the viability of the seeds was directly proportional to the amount of rainfall in the district where they were stored, the injury becoming more pronounced as the temperature became higher. He established the fact that there was a close relationship between the loss of viability and the increase of moisture, the effect increasing with a rise of temperature both in the sealed and open bottles and packages.

Toole and Brown(9) listed insect injury, high temperature and high moisture as limiting factors affecting the life of the seed. They stated that seed would endure a relatively high moisture if the temperature was low but not freezing, and relatively high temperature if the moisture content was kept low. A combination of both induces rapid respiration, resulting in a rapid destruction of the viability of the seeds. They concluded that when seed was produced in a moist climate, it retained a high percentage of moisture and when kept in shipboard for a long time as in the case of imported seed, it lost its viability rapidly when brought into a warm country.

The work of Heinrich(4) on the influence of atmospheric moisture, temperature and oxygen of the air on stored seeds showed that although such seeds were high in hygroscopic water content they were able to retain their viability for a longer period when fresh air was admitted than when there was no ventilation. Previous drying of the seeds did not prolong their viability if there was free access of air, but when artificially dried-stored in air-tight containers, the viability of the seeds was greatly prolonged even at high temperature (30° C.). Low temperature (below 5°C.), without exception, prolonged the viability of the stored seeds even though they contained a large amount of hygroscopic moisture. Guillaumin(3) reported that dryness and reduction of air pressure prolonged the germinability of seeds while Tillotson(8) obtained the best germination from seeds stored in localities of high altitude but of low relative humidity.

Vibar and Rodrigo(10) in their work on the storing of some farm crop seeds in the Philippines found that seeds stored in

sealed containers with and without naphthalene remained strongly viable from two to four or more years while those in cloth bags lost their viability in less than a year, with a few exceptions. Rodrigo(5), continuing the work above mentioned, reported that some of the bean seeds stored in air-tight containers remained viable for over 11 years.

San Pedro(7) of the College of Agriculture, U. P., Agricultural College, Laguna in his work on the influence of moisture and temperature on the viability of some vegetable seeds found that the former factor (moisture) exerted more influence on the viability of the seeds than the latter (temperature).

MATERIALS AND METHODS

Ten different kinds of vegetable seeds were used in this study. These were Surehead cabbage, *Brassica oleracea* var. *capitata* L.; Early Patna cauliflower, *Brassica oleracea* var. *botrytis* L.; Chinese pechay, *Brassica cernua* Tumb.; Chinese long radish, *Rhaphanus sativus* L.; Big Boston lettuce, *Lactuca sativa* L.; Yellow Bermuda onion, *Allium cepa* L.; Japanese purple eggplant, *Solanum melongena* L.; Bontoc pepper, *Capsicum frutescens;* Mary Washington asparagus, *Asparagus officinalis* L.; and cucumber, *Cucumis sativus* L. The seeds of cabbage, cucumber, and lettuce were imported from the United States; those of onion from the Canary Islands; those of cauliflower from India; and those of radish and pechay from China; while those of asparagus, eggplant and pepper were produced at the Lipa Citrus Experiment Station, Lipa, Batangas. With the exception of those locally produced which were harvested a little over one month before the experiment was started, no information is available about the date of their harvests. It is assumed that they were comparatively new.

Before storing the seeds, each kind was thoroughly mixed and samples were taken for the determination of their initial germination. The seeds were then thoroughly dried in an electric oven with a temperature ranging from 45° to 50° C. for about two days. Likewise the vials (9 cm. long, 1.5 cm. in diameter) which were to be used as containers were also dried in the oven.

The seeds were put in the vials while still warm. Each kind of the ten vegetable seeds was represented by 80 sealed and 12 unsealed vials. Thus, the seeds were stored (1) under air-tight condition and (2) under the influence of air and its

relative humidity. The sealing of the seeds was accomplished by dipping the corked end of the vials in melted paraffin. These were labeled, arranged in a box and kept in the laboratory of the Horticulture Section, Bureau of Plant Industry.

The seeds of pepper and asparagus were stored on June 16 and 19, 1935 respectively; those of radish, cabbage, pechay, lettuce, cucumber, and onion on June 25, 1935; while those of cauliflower and eggplant were stored on August 14, 1936. The monthly testing of the viability of the different seeds was made every 21st of the month. In the event that the 21st was either Sunday or holiday, the testing was advanced or delayed one or two days as indicated in the results. A vial was opened only when seed samples were taken for germination test after which such vial although immediately sealed was separated from the experimental vials. One vial each of the sealed and unsealed seeds of each kind was weighed every month to determine the loss or gain in weight if there was any.

In the germination tests, a soil medium composed of fine sand and loam soil put in a seedbox was used. The soil was kept moist during the tests. Enough time was given the seeds to germinate after which the seedlings were pulled off and counted. For some time after this, the box was watered for further observations on germination. As a rule, it took from 10 to 15 days to complete the observation on one monthly test. After this, the soil medium was thoroughly stirred and dried for future use.

EXPERIMENTS AND RESULTS

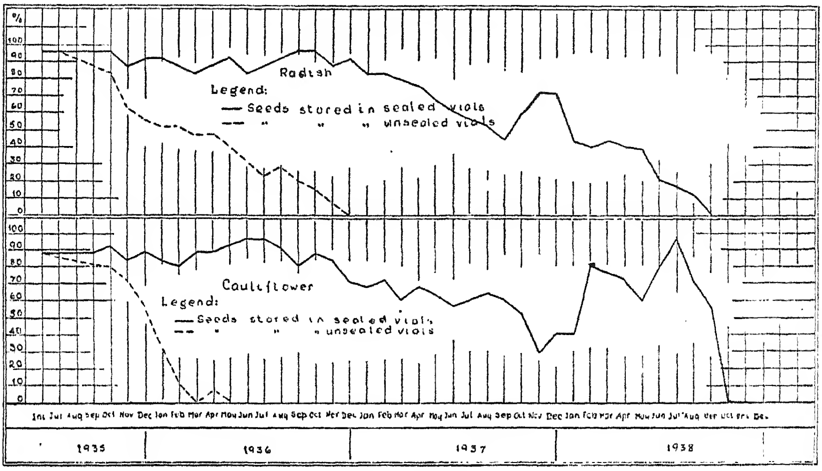
The study was started on June 25, 1935 and the last germination test was made on November 21, 1938, covering a period of 41 months. At the close of the experiment, some of the seeds in the sealed vials were still highly viable. The seeds in the unsealed vials lost their viability quite early. Table 1 presents the results of the monthly germination tests throughout the duration of the experiment. Table 2 is a summary of table 1, while table 3 shows the gain or loss in weight of the seeds during the progress of the study.

Graphs 1 to 5 were made to show in a vivid manner the trend of the viability of the seeds of the different vegetables as stored in sealed and unsealed containers.

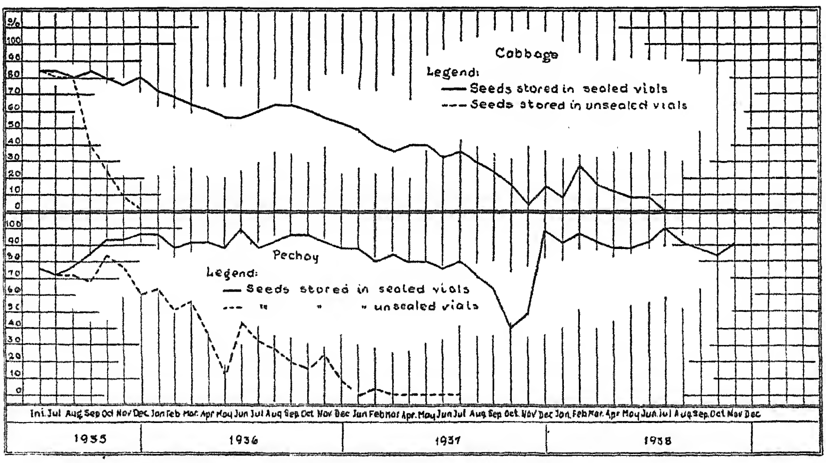
DISCUSSION OF RESULTS

As may be seen in table 1, the viability of the seeds used in this study was greatly dependent upon the kind of seed and

upon the method of storing employed. In all cases, the loss of viability was very rapid with the seeds that were kept in unsealed vials where they were affected by the relative humidity of the air. On the other hand, the seeds that were kept in



Text FIGURE 1.



Text FIGURE 2.

sealed containers were able to maintain their viability much longer as will be shown later.

Seeds stored in unsealed vials.—As already stated, the seeds kept in unsealed vials lost their viability within a comparatively short period. For example, the cabbage and lettuce seeds began to be critical in their viability in three and four months,

TABLE 1.—*Monthly germination of 10 kinds of vegetable seeds stored in unsealed and sealed vials.*

Date test made	Radish		Cauliflower		Cabbage		Pechay		Lettuce		Cucumber		Onion		Asparagus		Eggplant		Pepper	
	Un-sealed	Sealed	Un-sealed	Sealed	Un-sealed	Sealed	Un-sealed	Sealed	Un-sealed	Sealed	Un-sealed	Sealed	Un-sealed	Sealed	Un-sealed	Sealed	Un-sealed	Sealed	Un-sealed	Sealed
	Per cent	*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Per cent*
1935																				
Initial germination	96	96	88	88	84	84	76	76	67	67	64	64	76	76	88	88	80	80	92	92
July 20	96	96	-----	-----	80	84	72	72	68	68	60	60	72	72	88	92	-----	-----	92	92
August 21	92	96	84	88	80	80	72	76	60	68	64	68	64	80	84	88	80	80	88	88
September 21	88	96	80	88	40	84	68	84	60	72	64	64	72	76	84	96	80	84	84	84
October 21	84	96	80	92	24	80	84	92	52	76	56	60	68	76	80	92	76	84	76	88
November 21	64	88	72	84	8	76	76	92	20	72	32	64	60	80	76	92	76	88	72	88
December 21	56	92	56	88	0	80	60	96	0	68	32	64	56	84	84	96	40	80	36	92
1936																				
January 21	52	92	32	84	0	72	64	96	4	68	24	56	52	84	80	84	48	84	36	84
February 21	52	88	12	80	0	68	52	88	0	72	12	60	48	88	80	88	64	88	28	96
March 21	48	84	0	88	0	64	56	92	0	64	4	56	16	84	72	92	60	88	32	96
April 21	48	88	8	88	0	60	36	92	0	68	8	52	0	80	64	88	56	92	20	92
May 21	40	92	0	92	0	56	12	88	0	64	0	44	8	76	56	80	60	92	12	88
June 20	32	84	0	96	0	56	44	100	0	56	4	48	4	80	60	88	52	92	4	88
July 21	24	88	0	96	0	60	32	88	0	56	0	44	0	80	44	84	56	96	0	92
August 21	28	92)	0	92	0	64	28	92	0	60	0	60	0	72	28	92	60	88	4	84
September 21	20	96	0	80	0	64	20	96	0	52	0	56	0	76	16	84	48	98	0	84
October 21	16	96	0	88	0	60	16	96	0	44	0	48	0	68	16	84	40	84	8	92
November 21	8	88	0	84	0	56	24	92	0	36	0	48	0	60	12	80	24	92	0	84
December 21	0	92	0	72	0	52	8	88	0	40	0	40	0	40	4	76	32	88	0	84
1937																				
January 21	0	84	0	68	0	48	0	88	0	40	0	32	0	44	0	76	16	84	0	88
February 20	4	84	0	72	0	40	4	80	0	32	0	24	0	36	8	80	0	80	0	80
March 22	0	80	0	60	0	36	0	84	0	40	0	24	0	24	0	72	8	72	0	84
April 21	0	76	0	68	0	40	0	80	0	48	0	16	0	8	0	76	0	76	0	76
May 21	0	68	0	64	0	40	0	80	0	16	0	12	0	0	0	80	0	68	0	72
June 21	0	60	0	56	0	32	0	76	0	0	0	20	0	4	0	84	0	64	0	76
July 21	0	56	0	60	0	36	0	80	0	12	0	8	0	0	0	88	0	72	0	68
August 21	0	52	0	64	0	28	0	72	0	8	0	4	0	4	0	84	0	76	0	64

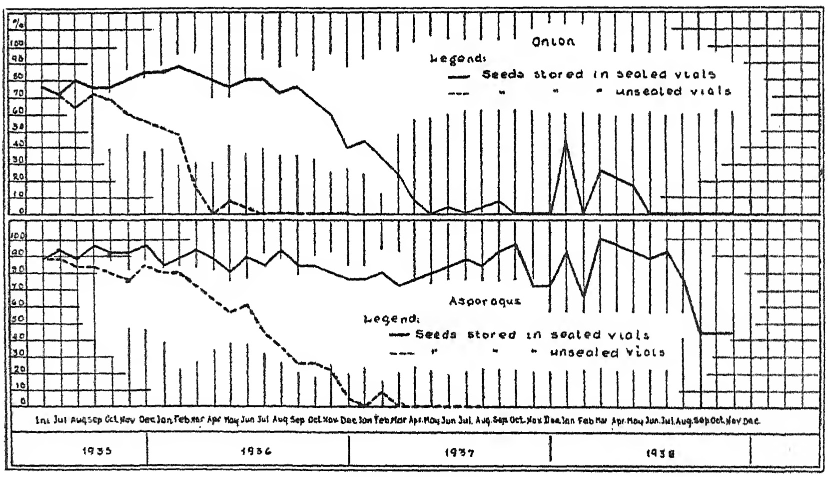
September 21	0	44	0	60	0	24	0	64	0	0	0	4	0	8	0	92	0	80	0	52
October 21	0	60	0	52	0	16	0	40	0	0	0	12	0	0	0	96	0	64	0	68
November 22	0	72	0	28	0	4	0	48	0	0	0	4	0	0	0	72	0	80	0	68
December 21	0	72	0	40	0	16	0	100	0	0	0	0	0	0	0	72	0	28	0	84
1938																				
January 21	0	44	0	40	0	8	0	92	0	0	0	0	0	44	0	92	0	40	0	80
February 21	0	40	0	80	0	28	0	96	0	0	0	20	0	0	0	64	0	0	0	92
March 21	0	44	0	76	0	16	0	92	0	0	0	12	0	16	0	100	0	0	0	84
April 21	0	40	0	72	0	12	0	88	0	0	0	16	0	12	0	96	0	0	0	80
May 21	0	36	0	60	0	8	0	88	0	0	0	0	0	8	0	82	0	0	0	66
June 22	0	20	0	80	0	8	0	92	0	0	0	4	0	0	0	88	0	0	0	64
July 21	0	16	0	96	0	0	0	100	0	0	0	0	0	68	0	92	0	44	0	92
August 22	0	12	0	72	0	0	0	92	0	0	0	8	0	0	0	76	0	0	0	76
September 21	0	0	0	56	0	0	0	88	0	0	0	0	0	0	0	44	0	60	0	92
October 21	0	0	0	0	0	0	0	84	0	0	0	0	0	0	0	44	0	54	0	82
November 21	0	0	0	0	0	0	0	92	0	0	0	0	0	0	0	44	0	60	0	52

TABLE 2.—*A summary of table 1, giving the comparative longevity of different vegetable seeds when stored in sealed and unsealed containers.*

Name of seed	Number of days to germinate	Number of months from storing to:			
		Unsealed vials		Sealed vials	
		Viability critical	Viability lost	Viability critical	Viability lost
Radish	3– 6	10	18	21	39
Cauliflower	4– 6	6	11	37	39
Cabbage	2– 5	3	6	23	37
Pechay	3– 7	10	21	[a] 41	----------
Lettuce	3– 9	4	8	17	27
Cucumber	3– 7	5	13	17	39
Onion	4– 9	8	13	15	38
Asparagus	5–12	14	21	38	[a] 41
Eggplant	4–10	13	21	28	[b] 40
Pepper	4– 8	6	17	[b] 41	----------

[a] At this period, the seed was still strongly viable.
[b] At this period, the seed was still giving a fair viability.

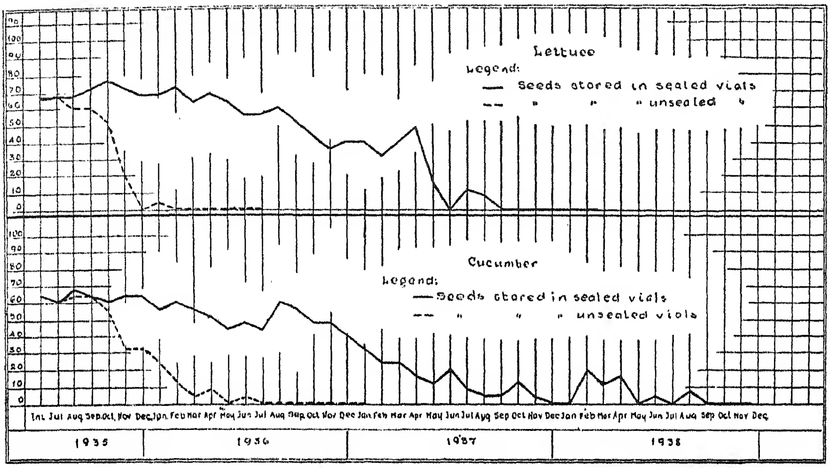
respectively after storage; cauliflower and cucumber in six and five months, respectively; pepper in six months; onion in eight months; radish in ten months; pechay in ten months and eggplant and asparagus in thirteen and fourteen months, respec-



Text FIGURE 3.

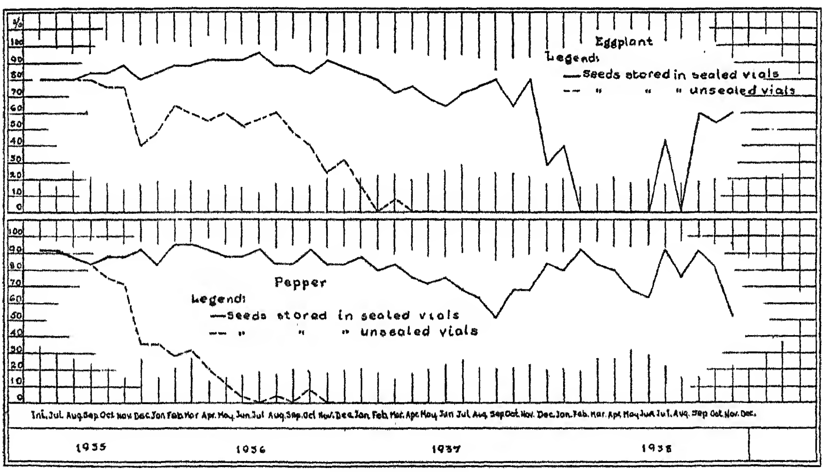
tively. The deterioration of the seeds in the unsealed vials was rapid after their viability became apparently critical. The cabbage completely lost its viability after six months; cauliflower in 11 months; cucumber in 13 months; pepper in 17

months; onion in 13 months; lettuce in 8 months; radish in 18 months; asparagus, eggplant, and pechay in 21 months. In this connection it may be stated that a corked vial is a better storing receptacle than either cloth or paper bag, the common containers



Text FIGURE 4.

used by local seed dealers. The viability of seeds stored in the latter containers is lower.



Text FIGURE 5.

According to table 3, the seeds stored in unsealed vials gained in weight ranging from 0.4 to 1.1 grams per vial within a period of one year, while those in the sealed vials did not gain in

weight with the exception of radish and cucumber which gained 0.1 and 0.2 grams per vial, respectively. The increase in weight must have been due to the absorption of moisture from the air.

TABLE 3.—*The gain (+) or loss (—) in weight by months of different vegetable seeds stored in unsealed and sealed containers.*

Date test made	Radish		Cauliflower		Cabbage		Pechay		Lettuce	
	Un-sealed	Sealed	Un-sealed	Sealed	Un-sealed	Sealed	Un-sealed	Sealed	Un-sealed	Sealed
	gm.	*gm.*	*gm.*	*gm.*	*gm.*	*gm.*	*gm.*	*gm.*	*gm.*	*gm.*
7-21-35	0.3	0.0	0.0	0.0	0.4	0.0	0.1	0.0	0.0	0.0
8-21-35	0.2	0.0	0.0	0.0	0.2	0.0	0.2	0.0	0.1	0.0
9-21-35	0.1	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.2	0.0
10-21-35	0.0	0.1	0.3	0.0	0.1	0.0	0.1	0.0	0.1	0.0
11-21-35	0.0	0.0	0.0	0.0	0.2	0.0	0.2	0.0	0.0	0.0
5-21-36	0.1	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6-21-36	0.0	0.0	0.1	0.0	0.1	0.0	0.2	0.0	0.1	0.0
7-21-36	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total gain or loss	0.7	0.1	0.8	0.0	1.0	0.0	0.8	0.0	0.5	0.0

Date test made	Cucumber		Onion		Asparagus		Eggplant		Pepper	
	Un-sealed	Sealed	Un-sealed	Sealed	Un-sealed	Sealed	Un-sealed	Sealed	Un-sealed	Sealed
	gm.	*gm.*	*gm.*	*gm.*	*gm.*	*gm.*	*gm.*	*gm.*	*gm.*	*gm*
7-21-35	0.3	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.2	0.0
8-21-35	0.2	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.3	0.0
9-21-35	0.1	0.0	0.3	0.0	0.1	0.0	0.1	0.0	0.1	0.0
10-21-35	0.1	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
11-21-35	0.1	0.0	0.3	0.0	0.2	0.0	0.2	0.0	0.1	0.0
5-21-36	0.1	0.2	0.2	0.0	0.0	0.0	0.1	0.0	0.1	0.0
6-21-36	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7-21-36	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0
Total gain or loss	1.1	0.2	1.0	0.0	0.8	0.0	0.4	0.0	0.8	0.0

The increased moisture content of the seeds was the cause of the rapid deterioration of their viability. This finding corroborates the findings of Duvel(2) and of Heinrich(4).

Seeds in sealed vials.—The different seeds that were kept in sealed vials were able to keep their viability much longer than their counterparts which were kept in unsealed but corked vials (table 1). This finding corroborates the results of Vibar and Rodrigo(10) in their study of the storing of some farm crop seeds and of Heinrich(4) in which they found that keeping seed in air-tight containers was a much more efficient way of preserving the viability of seeds.

This finding should be of great value to gardeners as well as to seed houses and scientific workers. It reduces seed storage to a simple, practical, economical but still efficient method.

The shortest-lived seed in the sealed vials lasted 27 months in storage before it completely lost its viability as compared with the six months of the shortest-lived seed in the unsealed vial. The longest duration attained by the seeds in unsealed vials was that of eggplant and pechay seeds and these lasted 21 months only, shorter by six months when compared with the shortest lived in the sealed containers. Text figures 1 to 5 show in a vivid manner the trend of the viability of the seeds stored in sealed and unsealed vials. It is conclusively shown that seeds which were not affected by the humidity of the air while in storage kept their viability much longer—from 190 to over 720 per cent.

The range in the longevity of the seeds in the sealed vials varied from 27 months to over 41 months. The lettuce seeds completely lost their vability after 27 months in storage; cabbage after 36 months; onion after 38 months; cauliflower, radish and cucumber after 39 months; asparagus after 40 months. Eggplant, pechay, and pepper were still germinating after 41 months in storage.

A further study of table 1 will show some interesting phenomenon which as far as the writers have been able to ascertain only one investigator has made mention of (5). Reference is made to the rise in the percentage of germination of most of the seeds after they have shown some signs of weakness in their germination. This rise in the percentage of viability is well illustrated in the graphs herewith presented, particularly in the case of pepper, eggplant, onion, pechay, cauliflower and radish. For example, pechay, after the 17th month in storage, gradually began to show weakening of viability until the 28th and 29th months when its germination went down to 40 and 48 per cent. After this, the seed again showed very strong viability up to the 41st month when this experiment was closed, the germination ranging from 84 to 100 per cent with an average of 92 per cent for a period of 12 months. Such was also the case with the other seeds studied although this renewed vigor was manifested in a lesser degree. The fact that all the seeds used in this study manifested in a greater or lesser degree some striking evidence of renewed vigor of viability without any change of treatment seems to make the claim of Rodrigo (5)

stronger that "this renewed life activity after a period of semi-dormancy" . . . "is a natural phenomenon manifested in many other ways in the life of both plants and animals." His recent findings that 13-year-old mungo (*Phaseolus aureus* Roxb.) seeds produced more beans than 1-month-old seed (6) is another striking manifestation of this seemingly natural yet little known phenomenon.

SUMMARY OF CONCLUSIONS

The results presented in this study seem to justify the following conclusions:

1. The viability of the seeds was dependent upon their kind but was greatly affected by the method of storage employed.

2. Seeds stored in corked but unsealed vials lost their viability within a very much shorter length of time than those that were stored in sealed or air-tight vials. The latter seeds remained viable about 190 to 720 per cent longer than the former.

The seeds in unsealed vials began to be critical in their viability in three to 12 months after storage and completely lost their viability in six to 21 months, while those in air-tight containers did not lose their viability until after 27 to over 41 months in storage.

3. The rapid loss in viability of the seeds in unsealed containers was due to the absorption of moisture, which naturally must have started some degree of metabolism.

4. An interesting phenomenon was found on the behavior of the seeds kept in sealed vials. In a lesser or greater degree, they manifested a striking evidence of renewed vigor in their viability after they have become critical in their germination.

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48721——5

ON CHRISTISONIA WIGHTII ELMER, A PARASITE OF SUGARCANE [1]

By EDUARDO QUISUMBING

Chief, Natural History Museum Division, Department of Agriculture and Commerce

TWO PLATES

Christisonia Wightii Elmer is the only representative of this genus reported from the Philippines and is known only from the Archipelago. Of the sixteen species known to science up to 1925, thirteen occur in India proper and Ceylon, one in Thailand (Siam), one in the Malay Archipelago, and one in the Philippines. It was originally collected by Mrs. M. S. Clemens, on April 16, 1907, from Camp Keithley, Lanao Province, Mindanao, but was first described by Mr. A. D. E. Elmer from material collected by him near Dumaguete, Oriental Negros Province, in the island of Negros. The plants were found growing in rich damp ground among tussocks of *Amomum fusiforme* Ridl. along the upper edge of a deep ravine at 1,750 feet elevation. It is known in the Visayan dialect of Negros as *bunga*, and *bulac sang tubo*.

Mr. Federico P. Goseco who discovered this plant growing in association with sugarcane plants early in July, 1931, at the Hacienda de Agua, La Carlota, Occidental Negros, suspected it to be a parasite like *Aeginetia indica*, another Philippine representative of this family. The possibilities of the spread of this plant and its infestation of cane fields warranted a more critical study of its habit and habitat. A good number of sugarcane hills with the *Christisonia Wightii* attached had been dissected very carefully, and the plant in question was found to be a parasite. Observations made in the field showed that this parasite is not as destructive as the other root parasite (*Aeginetia indica*) of sugarcane. It is, however, found best that once this parasite is discovered in a clump of sugarcane the particular hill should be dug up right away. The parasite causes yellowing of the leaves first, but later completely kills the plant, drying it.

[1] Received for publication June 26, 1940.

OROBANCHACEAE

Genus CHRISTISONIA Gardiner

Christisonia Wightii Elmer

Christisonia Wightii Elmer in Leafl. Philip. Bot. 8 (1915) 2793; Merr. Enum. Philip. Fl. Pl. 3 (1923) 448.

The original description is as follows:

Terrestrial and saprophytic, succulent; stem erect, short, solitary or usually few-branched and much winged toward the top; 5 cm long, occasionally forming clumps; 1 cm thick, striate, glabrous, dirty yellowish white or brown, the longer curved, enveloped with similarly colored and glabrous imbricating scales of diverse sizes and shapes; bracts or scales toward the base short and scattered, those at the top much longer and well imbricated; branches commonly 3, arising from near the same place toward the distal end of the short thick stem, all densely surrounded at the base by numerous broadly oblong scales, very short and equally provided with imbricating scales especially toward their distal ends which bear either one or more terminal and erect flowers. *Flowers* odorless, protruding above the humus ground layer; *bract* subtending the calyx 1.75 cm long, 1.25 cm wide, coriaceous, glabrous, elliptic in outline, chiefly covering over the upper side of the calyx; *calyx* dark yellow or brownish, succulent, glabrous, subterete, nearly 2.5 cm long, 7.5 mm thick above the middle, a trifle narrower at the base, throat oblique and well slit open from the lower side, the upper end very broadly toothed, lateral teeth smaller, the lower end minutely lobed or not at all, early decaying or withering and forming a slimy dirty watery mass; corolla white especially on the interior except a rather conspicuous blotch in the lower corolla segment; 5 cm long, 5 mm thick toward the base, gradually inflated toward the very oblique throat, protruding above the humus covered foliage on the ground, curved above the middle and always facing down hill; fleshy, 1.5 cm across the throat, glabrous; segments about 5, subequal, 2.5 cm across when in full anthesis, rotately spreading, suborbicular; stamens apparently as many as corolla lobes, *included*; filaments glabrous, ribbon-like adnate except their distal ends above the middle of the corolla; anther block-shaped, 3.5 mm long, subbasifixed; pistil glabrous, nearly 5 cm long; ovary ellipsoidly elongated upon a concrete base; style subterete, equalling the corolla tube; stigma composed of 2 broad and fleshy lobes; ovules indefinite, dark brown, divided into 2 general masses.

Type specimen number 9510, A. D. E. Elmer, Dumaguete (Cuernos Mts.), Province of Negros Oriental, Negros, March, 1908.

Collected from rich damp ground among the tussocks of *Amomum fusiforme* Ridl. along the upper edge of a deep ravine at 1,750 feet altitude. "Satagbak" in the Visayan dialect.

In *Zingiberaceae* a botanist must know how to unearth the flowers or fruits of certain species in the field. In this case the collector thought these flowers represented a wild species of ginger, so I was particular to locate its leaf-bearing stems. Quoting from my field label,—"The clumps seem to lie loose in the fertile soil beneath the humus covering

and no connection was found with other living plants." A specimen was, however, sent with my other *Zingiberaceae* to *Dr. Ridley* for determination and who pronounced it a species of *Christisonia*. It is then dedicated to *Robert Wight* who figures a number of species of this saprophytic genus in his Icones Plantarum IV. It is here for the first time reported from the Philippine Islands."—ELMER, l.c.

LUZON, Bontoc Subprovince, Bauco, *M. Vanoverbergh 798, 1301,* in forests, altitudes 1290 to 1680 meters: Benguet Subprovince, Bugias, *E. D. Merrill 4656,* in deep steep banks, flowers fragrant; Baguio, *For. Bur. 5098 H. M. Curran:* Bataan Province, Limay, *Bur. Sci. 6173 C. B. Robinson:* Rizal Province, along the Pililla-Mabitac trail, *Bur. Sci. 11942 C. B. Robinson,* in sand besides streams in remains of bamboo formation, altitude 250 meters: Laguna Province, Calauan, *Bur. Sci. 12472 R. C. McGregor,* on a hill growing on bamboo clumps; Mt. Maquiling, *W. H. Brown, s. n.,* in the woods, altitude about 700 meters; Mount Banajao, *For. Bur. 8030 H. M. Curran & M. L. Merritt:* Tayabas Province, Mt. Malarayat, *For. Bur. 7828 H. M. Curran & M. L. Merritt,* altitude about 900 meters. NEGROS, Oriental Negros Province, Dumaguete (Cuernos mountains) *A. D. E. Elmer 9510* (type), March 1908: Occidental Negros Province, La Carlota, *F. P. Goseco, s. n.* November and December 1931, growing in clumps of sugarcane plants. MINDANAO, Lanao Province, Camp Keithley, *M. S. Clemens 1011,* April 16, 1907, growing in damp, slippery soil on the upper margins of the forested slopes, altitude about 800 meters. This parasite has also been observed in sugarcane fields in Salamanca, de Agua, Fe, Caiñaman, Monserrat, and Carmen Grande, all in Occidental Negros Province.

The additional descriptive data are based upon living plants sent in by Mr. Goseco.

The plant is perennial and leafless, growing vigorously and often encircling the sugarcane clumps. The stems are from 2 to 10 cm high, branched, the branches up to 5. The racemes are few-flowered, terminal and short. The flowers are fleshy, from 6 to 7 cm long. The calyx is tubular, spathose, 5-fid, 4 to 4.2 cm long, 1.7 to 1.8 cm in diameter. The corolla is funnel-shaped, wide at the mouth, 4.5 to 5 cm long; the lobes 5, suborbicular, the superior 3 large, the two inferior ones smaller. The stamens are four, the two are spurred, and the other two spurless; the spurs fleshy, curved. Capsules 2-valved, the placenta fleshy. Seeds very minute, numerous, oblong, testa pitted.

After anthesis and ripening of the seeds, a mucilaginous, sticky substance is found between the calyx and the corolla tube, the corolla tube decaying first. The bracts are corinthian red, the corolla tube is white or massicot yellow, the throat of the tube within is empire yellow, the lobes are lavender violet or mauve, the rim amethyst purple. The ovary is white, as are the style and stigma. The calyx is alizarine pink or jasper pink, in some cases almost white, particularly in the case of those buried in the soil.

ILLUSTRATIONS

PLATE 1

FIG. 1. Habit, very much reduced.
2. Habit at base of a stem of sugarcane, reduced.
3. Flowers, reduced.
4. The parasite roots and sugarcane roots: p. parasite; s. sugarcane.

PLATE 2

FIG. 1. Opened and unopened flowers, reduced.
2. Flower, viewed from above, natural size.
3–4. Longitudinal section of a flower, showing calyx, corolla, pistil and two stamens, × 0.05.
5. Detail of two stamens, one with the spur, × 2.
6. Transverse section of ovary, × 7.
7. Seeds, very much enlarged.

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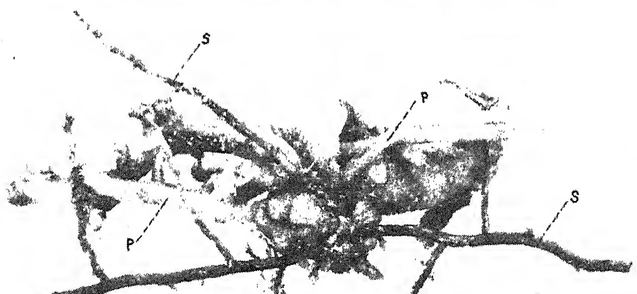

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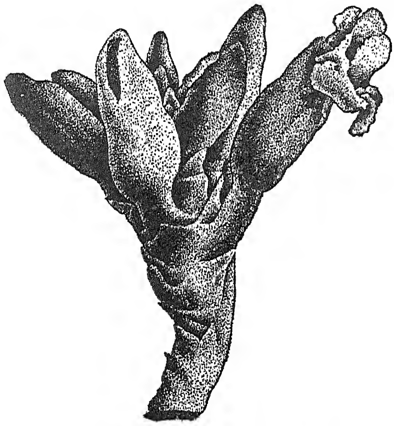

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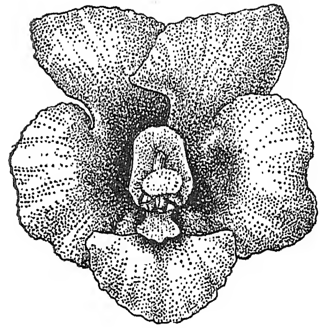

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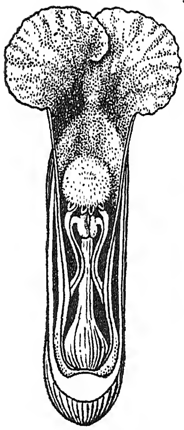

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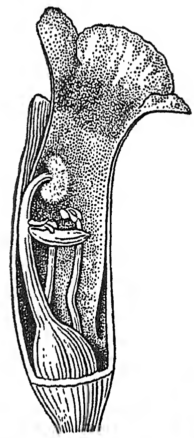

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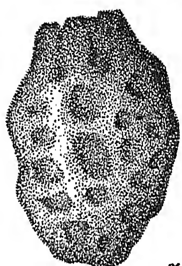

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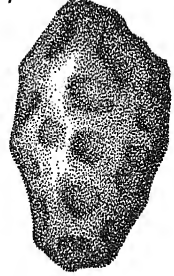

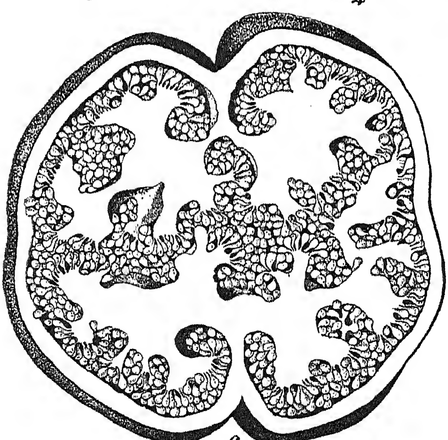

6

PLATE 2.

INSECT AND OTHER PESTS OF CORN [1]

By Faustino Q. Otanes and Leopoldo T. Karganilla

Of the Plant Pest and Disease Control Division
Bureau of Plant Industry

EIGHT PLATES

The main object of this work is to bring together such available information so far, published and unpublished, about the insect and other pests of corn in the Philippines as is believed to be of value as a guide to fieldmen of the Bureau of Plant Industry and others engaged in agricultural promotional work in their efforts to aid farmers towards minimizing the ravages of such corn enemies. The emphasis being given to the production of food crops makes the need for this work the more urgent.

Incidentally, this paper gives an idea of the present status of our knowledge of insects, in particular, infesting corn. Indeed more investigational or research work has yet to be done with the object of finding out more about the biology or life-history of such insects, with due consideration to the climatic and other factors in different localities, as a basis for the search for practical and effective control measures. Pending further studies, the writers have ventured in certain cases to give suggestions with the thought that these may be of value to farmers towards lessening, to a certain extent, the ravages of the pests that attack their corn crops.

GENERAL CONSIDERATIONS

All plants are susceptible to the attack of one pest or another and corn is not an exception. No part of the corn plant is free from attack. There are as yet no estimates as to the value of the total annual damage caused by corn pests, but it may be said that the amount is by no means small. Reports of almost total destructions of corn plantings by corn borers, armyworms, corn earworms and rats are often received by the Bureau of

[1] Received for publication March 26, 1940.

[2] To be reprinted as popular bulletin No. 18.

Plant Industry. Serious destructions by the corn silk beetle have also been reported. Besides the direct injuries caused by these and other insects to corn, it is also suspected that some of them, more particularly the sucking insects, such as corn leaf aphid and the corn leaf hopper, are known to be instrumental in the transmission and spread of corn diseases.

In this work, the pests of corn are grouped and discussed as follows:

Pests	Parts damaged
A. *Pests of corn in the field:*	
a. Insect pests	
1. Migratory locust (*Locusta migratoria manilensis* Meyen)	Leaves and stalks.
2. Corn borer (*Pyrausta nubilalis* Hubn.)	Tassels, leaves, stems and ears.
3. Corn earworm *Heliothis armigera* Hubn. (*Chloridea obsoleta*)	Unfolded leaves, tassels, silk and ears.
4. Corn silk beetle (*Monolepta bifasciata* Hornst.)	Silk.
5. Cutworms and armyworms	Leaves, whole plants when young.
Grass armyworm (*Spodoptera mauritia* Boisd.)	
Common cutworm (*Prodenia litura* Fabr.)	
True armyworm (*Cirphis unipuncta* Haw.)	
Spotted cutworm (*Agrotis* sp.)	
6. Toy beetles (*Leucopholis irrorata* Chevr.)	Roots.
7. Corn leaf hopper	Leaves, and tender stalks.
Lantern fly of corn (*Peregrinus maidis* Ashm.)	
"Fulgorid" (*Proutista moesta* Westwood.)	
8. Corn leaf aphis (*Aphis maidis* Fitch)	Young leaves and tassels.
9. Corn thrips (*Frankliniella williamsi* Hood)	Leaves.
10. Corn leaf miner (*Agromyza* sp.)	Leaves.
b. Other pests	
1. Rats, wild hogs and monkeys.	Ears.
2. Parrots and crows.	Ears.
B. *Insect pests of stored corn:*	
1. Corn weevil (*Calandra oryzae* Linn.)	
2. The grey moth or Angoumois grain moth (*Sitotroga cerealella* Oliv.)	

THE ORIENTAL MIGRATORY LOCUST (*LOCUSTA MIGRATORIA MANILENSIS* MEYEN)

The Oriental Migratory Locust is one of the most important enemies of corn, as well as of rice and sugarcane. In fact it is the most important enemy of these food crops whenever there is a serious outbreak. The insects cause damage to corn in two ways:

1. Direct damage by the adults or flyers and hoppers to the crop.
2. Delayed planting of corn. Whenever locusts are rampant the farmers delay the planting and some do not plant at all.

For these reasons, the yields of corn in infested localities are reduced and accordingly many families suffer from want.

Life history and habits.—In common with other migratory locusts in other countries, the Oriental Migratory Locust has three phases in its life history, namely, phase *solitaria,* phase *transiens,*[1] and phase *migratoria,* which differ more or less in appearance and habits. During periods when there are no migratory swarms in any populated or cultivated area, the insects are known to exist as solitary locusts (phase *solitaria*), like ordinary grasshoppers (plate I, figs. 1 and 2). When conditions are unusual these solitary locusts begin to multiply into more or less thin or loose swarms. The individual insects (sub-phase *congregans* of the phase *transiens*) composing such swarms vary in color—some are green, others are brown and still others resemble the hoppers of the migratory phase, which are black and brick red in color. After a number of generations, the progeny acquire the migratory appearance and habits (plate 1, figs. 3 and 4). The more numerous the insects become, and as different groups come together to form larger aggregations, the stronger or keener the migratory instinct or impulse becomes and migrations to cultivated areas take place. This explanation of the origin of locust outbreaks is in accordance with the "phase theory" of Doctor B. P. Uvarov, of the Imperial Bureau of Entomology, London, England. Studies conducted in many countries, including the Philippines, show that the "phase theory" is the most logical explanation for the origin of outbreaks.

The Oriental Migratory Locust breeds in the uncultivated grasslands, of which there are extensive areas. Records of the

[1] The phase *transiens* has two sub-phases: *congregans* and *dissocians.* All of the progeny developing toward the migratory phase (*migratoria*) are of the phase *congregans;* those toward the solitary, *dissocians* (FQO).

old Bureau of Agriculture and its successor, the Bureau of Plant Industry, appear to show that the main breeding ground or outbreak area of the pest is found in Cotabato. Records also show that the outbreaks of the pest in the Philippines occur from 7 to 13 years, the average being about 10 to 11 years. Each outbreak usually persists for years. It reaches its maximum intensity within a certain year, after which it begins to decline. Owing to several factors, namely, the extensive campaigns waged, natural enemies, etc., the much reduced swarms tend to scatter and produce progeny (sub-phase *dissocians* of the phase *transiens*) culminating in the production of the solitary phase. Mostly individuals of this phase are therefore found between outbreaks. This temporary freedom of the cultivated areas from migratory swarm infestation may last for one or two years, after which another outbreak appears, which may again persist for years, the number depending partly upon the efforts exerted toward combating the pest. Thus the 1932 outbreak lasted only 7½ years, that is, until June, 1939. Since the average duration of outbreaks in the Philippines is 10 to 11 years, the duration of the 1932 outbreak had been curtailed by 2½ to 3½ years. For the first time too, so far as known, swarms had succeeded in reaching only Southern Luzon. In all other previous outbreaks, so far as known, the entire Philippines was invaded. This is apparently largely due to the extensive campaigns that have been waged, which were made possible by the larger appropriations that were given by the Government and to the wider application of scientific methods of control, particularly spraying with powdered soap solution and the use of poison baits, especially in the isolated areas.

The eggs of the locusts are laid in masses in holes in the soil made by the female. Each egg mass is covered with a white frothy substance which appears to serve as a protection from too much moisture in the soil and perhaps also from natural enemies. The eggs, which are yellowish brown or of the color of cheese, cucumber- or sausage-shaped, about 5 millimeters long and 1 millimeter in diameter, hatch normally in from 12 to 25 days.

The newly hatched hoppers are about 8 millimeters long and about 3 millimeters at their greatest width and are whitish upon emergence. They soon become dark in color. They molt five times and after each molt the migratory or gregarious color of the nymphs, which is black and orange or brick red, becomes more pronounced. The full-grown hoppers attain a length of

about 3.5 centimeters and a width of about 0.8 centimeter. The duration of the hopper stage, according to laboratory records, varies from 36 to 66 days. The duration of development from the time the eggs are laid to that when the hoppers change to adults is from 47 to 83 days.

The locusts begin to mate 22 to 34 days after emergence and the females commence laying eggs in one to two weeks after mating. A female may lay as many as 7 egg masses with a maximum total of over 500 eggs. Both males and females have been found to live as long as three months or over.

The period of development of the Oriental Migratory Locust may be summarized as follows:[2]

Egg stage	12 to 25 days
Hopper stage	
1st instar	6 to 10 days
2nd instar	6 to 9 days
3rd instar	6 to 14 days
4th instar	7 to 17 days
5th instar	11 to 16 days
Total for hopper stage	36 to 66 days
First mating	22 to 34 days, after the emergence of the adults.
First egg laying	7 to 14 days, after first mating.

According to these records the duration of development of the insects from the time the eggs are laid to that when the hoppers change to adults varied from 48 to 91 days.

Control measures.—In the control of locusts the following control measures are employed:

1. Catching the flyers with nets and driving the hoppers into pits. These methods are effective especially in more or less well populated provinces and where the people comply strictly with the provisions of the Locust Act (No. 2472).

2. Spraying the hoppers with solutions of ordinary soft yellow laundry soap or powdered soap. The amounts ordinarily used are from 200 to 300 grams per petroleum canful of water. A bucket pump provided with at least 5 meters of rubber hose and with a good nozzle that will deliver the spray in a fine mist may be used for spraying.

3. Dusting with calcium arsenate, either alone or mixed with starch, such as "gaogao" or other fine carrier. Derris powder with a rotenone content of 2 to 4 per cent has been found deadly

[2] As these observations or records were made on insects taken from swarms, they must necessarily refer to the insects in the phase *migratoria* and also to others possessing characters of the phase *transiens* (FQO).

to both flyers and hoppers. This may be used if it can be manufactured in large quantities.

4. Application of poison baits. Bagasse bait, prepared as follows has been found especially attractive to hoppers:

Fine bagasse	4 petroleum canfuls
White arsenic or Paris green	1 salmon canful
Molasses (mixed fifty-fifty by volume with water)	Enough should be added until the mixture is uniformly and moderately moist.

The bagasse and white arsenic or Paris green should be mixed thoroughly before the molasses is added. Instead of bagasse, sawdust or fine rice chaff may be used.

Factors essential to success in locust control.—1. More civic spirit and better compliance, on the part of the people, with the provisions of Act No. 2472, otherwise known as the Locust Act.

2. Wider application of the scientific methods of control, such as the use of arsenical dust, derris dust and poison bait.

3. More financial outlay for the control of locusts at the sources, that is, in their breeding grounds or outbreak areas especially in Cotabato and Davao, Mindanao, in order to prevent, if possible, the formation of large swarms or at least minimize the swarms that invade cultivated and populated areas. The locust menace or evil should be combated at its very root, so to state. With more funds, such work as reforestation, afforestation, introduction, protection and multiplication of natural enemies of the locust, etc., which may lead to permanent control, can be properly attended to. Fundamental investigations on the biology and ecology of the insect, especially in the breeding or outbreak areas, as a basis for predicting outbreaks and for the timely application of appropriate control measures, can also be tackled in a detailed and systematic manner.

THE CORN BORER (*PYRAUSTA NUBILALIS* HUBN.)

This insect is not only serious to corn in the Philippines but also in other countries. It is widely distributed, having gained entrance and foothold in the United States, where at one time as much as $10,000,000 was appropriated for its eradication. Large sums are still being spent there annually for control and research work in which a large staff of technical men is employed. Although the insect is widely distributed in the Philip-

pines and is likewise destructive in this country, it has not received the attention that it deserves.

Injury.—The most important and most serious injury to the corn plant is the tunnelling and the feeding of the larvae within the stalks, ear stems and ears. The tassels, the midrib of the leaves, the brace roots and the stubbles are likewise tunnelled. Newly hatched larvae feed slightly upon the tender blades and also in between the leaf sheaths and stalks.

DESCRIPTION AND LIFE HISTORY

The eggs (plate 2, fig. 1).—The eggs are flat, oval-like, shiny and are laid in a fish scale-like arrangement on the underside of the corn leaves. Newly laid eggs are pale yellow, but gradually change to brown and finally to black when about to hatch. In Manila, the eggs were found to hatch in from 4 to 6 days.

Larva or caterpillar (plate 2, fig. 2).—The newly hatched larvae are pinkish, with black or brown head and dark semicircular spots on the body, and are about 2.5 millimeters long. The full-grown larvae are creamy and dirty white, and are spotted with numerous small, brown, semicircular spots. Records of breeding work conducted in the Entomology Laboratory of the Bureau of Plant Industry in Manila during 1937 and 1938 gave 18 to 41 days for the duration of the larval stage.

Pupa (plate 3, fig. 3).—The pupa is spindle-like, with the body tapering posteriorly. The general color varies from light brown to dark brown. The most posterior segment bears two slender spines which constitute parts of the cremaster. The pupal period was found to range from 5 to 12 days.

Adults (plate 2, figs. 4 and 5).—From the anterior end of the head to the posterior tip of the abdomen, the male moth (fig. 5) is about 13.5 millimeters long and is slender, while the female (fig. 4) is about 14.5 millimeters long and is robust. The general color of the male varies from pale brown to dark brown, while that of the female is quite variable, with different shades from pale yellow to light brown. The distal or apical third of the forewing of the male is usually crossed by two narrow zigzag streaks of pale yellow. Both the forewings and hindwings of the female are also crossed by two zigzag lines darker than the rest of the wing.

Control measures.—The control of the corn borer has always been a serious problem to farmers, because of the difficulty met

once the caterpillars have tunnelled into the different parts of the plant. The following methods of control, which are in the main, preventive, are suggested:

1. The corn field should be visited often and all infested plants should be cut or pulled out and destroyed or fed to livestock.

2. All corn stalks in the fields should be disposed of as soon as the ears are harvested, either by burning or feeding them to livestock.

3. All stubbles should be pulled out and burned or plowed under deeply.

4. High yielding corn varieties should be chosen for planting.

5. Other things being equal, the most resistant or least susceptible corn varieties should be planted.

6. A system of crop rotation, which should include the growing of legumes as a means of adding fertility to the soil, should be planned and practised.

7. Fertilizers should be used, if necessary, and all other requirements of the plants, such as cultivation, etc., should be attended to so as to produce vigorous plants, and thus enable them to withstand corn borer attack better.

8. Dusting corn plants periodically with calcium arsenate may be resorted to, but in using chemicals the cost of application and probable profit should be carefully figured out before they are employed. If possible, the Bureau of Plant Industry or its field agents should be consulted before any insecticide is used.

9. The corn borer is attacked by several parasites and predators. The introduction of additional natural enemies from other countries may be tried.

THE CORN EARWORM, *HELIOTHIS ARMIGERA* HUBN. (*CHLORIDEA OBSOLETA*)

Injury.—The corn earworm is considered one of the three most injurious pests of corn in the Philippines. Although the caterpillars show a decided preference for the corn ears (hence, the name) they also attack the leaves and tassels. Newly hatched larvae begin feeding on the silk and gradually work into the developing ears and feed on the kernels and even work their way into the cobs. The injury always results in "nubbins" or poorly filled tips. The insect also infests other plants, like cotton.

DESCRIPTION AND LIFE HISTORY

The eggs.—The eggs which are laid singly on the silk are hemispherical, slightly smaller than a pinhead. They are uni-

formly light yellow just after oviposition, but are mottled with reddish brown toward the end of the incubation period, which varies from 3 to 8 days.

Larva (plate 3, fig. 1).—The larva is the only destructive stage in the life of this pest. A newly hatched caterpillar is pale, yellowish-white, with black head, and walks with a looping motion. As it approaches pupation, the body is covered with wart-like dark humps, and the color varies from pale green to very dark brown. It measures about 3.75 centimeters when full grown. Larval period varies from 22 to 28 days.

Pupa (plate 3, fig. 2).—Pupating larvae burrow six inches deep into the soil, and at the end of the burrow they change into reddish or light brown, stout shiny pupae, of about 1.88 centimeters long. Pupal period varies from 7 to 9 days.

Adults (plate 3, fig. 3).—The color of the male moth varies from light to dull olive, while that of the female is fawn-like. The forewing of the former has a dark-centered circular spot midway between the apex and the base of the costal angle of either wing, while in the latter this distinguishing character is almost absent. The hindwings of both sexes are provided with dusky bands, those of the female being broader and darker. Wing expanse is from 30 to 40 millimeters.

Control measures.—The following control measures against the corn earworm are suggested:

1. Other things being equal, corn varieties with tight-fitting and long husks should be planted.

2. Cultural measures, such as use of fertilizers, intelligent or well planned crop rotation, etc., should be practised in order to increase the fertility of the land, thus producing more vigorous plants and more crops, and thus offsetting to a certain extent whatever damage might be caused by the caterpillars.

3. In the United States, dusting the silk of sweet corn with 1 part lead arsenate or calcium arsenate and 1 part finely ground sulphur (by volume) is employed. The application should be repeated every 3 to 4 days until the silk is dry, or the ears are ready for use. This may be tried for field corn.

4. Collecting the caterpillars will help toward minimizing the ravages of the pest.

5. Light traps may also be employed against the adults. A simple light trap consists of a lantern placed over a basin of water to which kerosene has been added. Light traps should be set timely, that is, even before the ears appear so as to catch the moths before they lay eggs.

The use of poison baits for the moths consisting of sugar, sodium arsenite and water is also suggested.

THE CORN SILK BEETLE (*MONOLEPTA BIFASCIATA* HORNST.)

The corn silk beetle, as the name implies, feeds on the silk of corn ears. It has also been found to feed on the young leaves of mango, avocado, camanchili, "camoteng cahoy," and castor bean. The insects are also known to attack mango blossoms, and newly opened flower buds of gumamela. They are apparently polyphagous feeders.

Injury.—The beetles cut and eat the silk threads of the corn ears. The injury prevents pollination and few or no kernels will develop. Cases of serious injury to corn have been reported from Leyte, Bohol, Nueva Ecija, Pampanga, and other provinces.

DESCRIPTION AND LIFE HISTORY

Adult (plate 6, fig. 4).—The adult beetle is from 4 to 6 millimeters long. The elytra or outer wings are buff yellow with a dark spot at the base or cephalic end of each elytron. Another pair of dark spots, of similar color and shape, is located towards the ends of the outer wings. The life history of this insect has not been worked out.

Control measures.—1. The planting of corn should be so timed that the production of silk and tassels does not coincide with the abundance of the beetles. Such period of abundance should be carefully observed in every locality.

2. The silk threads of the corn may be dusted with lead arsenate or calcium arsenate powder early in the morning.

3. Light traps against the adults have been found to attract large numbers of the beetles. Light trapping should begin early in order to catch most of the beetles before the corn plants tassel.

4. Before the corn tassels appear, trap crops, preferably "camoteng cahoy" (*Manihot utilissima*) may be planted and insects that gather on these plants may be killed by poison spray or by means of light traps.

CUTWORMS AND ARMYWORMS (SEVERAL SPECIES)

Among the most destructive pests the farmer and the gardener have to contend with, and which may cause untold damage to crops, oftentimes resulting in the complete destruction of wide areas of crops in a single night, are the so-called cutworms and

armyworms. These pests attack many farm and garden crops. In the Philippines rice and corn are commonly attacked by these pests. The following species have been found feeding on corn:

1. Grass armyworm (*Spodoptera mauritia* Boisd.)
2. Common cutworm (*Prodenia litura* Fabr.)
3. True armyworm (*Cirphis unipuncta* Haw.)
4. Spotted cutworm (*Agrotis* sp.)

Injury.—The injury to the corn plants varies according to the age of the plants and to the degree of abundance of the caterpillars. When they are abundant the injury oftentimes results in the complete destruction of the whole fields of young corn plants. The stems are cut and the whole plants are almost entirely eaten. On older plants, that is, those plants with tassels, very little injury, if any, has been noted.

GRASS ARMYWORM (*SPODOPTERA MAURITIA* BOISD.)

Outbreaks of the grass armyworm occur almost every year. The caterpillars attack not only corn but also rice, at times destroying whole fields.

DESCRIPTION AND LIFE HISTORY

The eggs.—"The eggs are yellow, hemispherical in shape and about the size of a pinhead." They are covered with short yellowish brown hairs from the abdomen of the female and are laid in clusters on the leaves. An egg mass may contain as many as from 200 to 300 eggs, which hatch within 2 to 4 days.

Larva (plate 4, fig. 2).—The caterpillars when newly hatched are less than 2 millimeters long, but attain a length of about 5 centimeters when full grown. The general color is light or dark brown, with pale stripes on each side. When they occur in large numbers and move in large groups they have two prominent black stripes along the back. These stripes sometimes coalesce so that the caterpillar appears entirely black. They usually feed at night and become full grown in about 14 to 23 days. The feeding of the caterpillars seems to be confined to plants of the grass family.

Pupa.—The pupa is reddish brown, and averages about 1.3 centimeters in length. Pupation takes place in the ground and the adult moths emerge in from 7 to 16 days.

Adult moth (plate 4, fig. 1).—The adult is about 1.5 centimeters long with a wing expanse of about 3 to 4 centimeters,

depending upon the sex. The male is somewhat smaller. The forewings are greyish-brown, with wavy line markings, and each with a dark spot near the middle. The hindwings are whitish with dark margins.

Available records of the life cycle of the insect from the time the eggs are laid to that when the adults emerge give a duration of 23 to 43 days.

COMMON CUTWORM (*PRODENIA LITURA* FABR.)

DESCRIPTION AND LIFE HISTORY

The eggs.—The eggs are laid in clusters on the leaves of plants and also on objects on the ground. The egg masses are covered with yellowish brown hairs, but these felt coverings are sometimes wanting on eggs laid later. The incubation varies from 2 to 4 days.

Larva (plate 4, fig. 4).—The newly hatched larvae are at first all together on the food plants, but later disperse. The young larvae are greenish, each with black band about one third the length, from the head or cephalic end. Dammerman (1929) describes a full-fed caterpillar as follows:

> Dark green, with a bright yellow dorsal line and similarly colored lateral stripes, which are edged above by semi-lunar black spots.

The caterpillar becomes full grown in 20 to 46 days. The caterpillars are remarkably polyphagous, feeding not only on plants of the grass family, but also on tobacco, cauliflower, cabbage, "tangan-tangan" (*Ricinus communis*), melons, peas, etc. They are undoubtedly the most destructive noctuid caterpillars in the Philippines.

Pupa.—The pupa is reddish brown but becomes dark reddish brown when the moth is about to emerge. The wing sheaths are darker than the body. The length is about 1.6 centimeters. The pupal stage varies from 8 to 11 days, according to records obtained in Manila.

Adult (plate 4, fig. 3).—The moths are about the size of that of *Spodoptera mauritia* but somewhat more robust than the latter. The forewings are purplish brown with a pattern consisting of numerous lines and spots, "while the hindwings are whitish, narrowly bended along the outer margin."

The life cycle from the laying of the eggs to the emergence of the adults varies from 30 to 61 days, according to available records.

TRUE ARMYWORM (*CIRPHIS UNIPUNCTA* HAW.)

DESCRIPTION AND LIFE HISTORY

The eggs.—The eggs are laid on grasses in the axils or protected parts of the plant. When newly laid they are smooth, shining and milky-white. They are apparently spherical, but when laid in rows, they are compressed on both sides. The incubation period varies from 4 to 5 days.

Larva (plate 4, fig. 6).—The larvae are greenish or purplish brown dorsally, but paler ventrally. Above and beneath the stigmata is a pale stripe, with a dark line running posteriorly down the middle of the back. They are nocturnal in habits, like other species. When full grown the larva measures about 4 centimeters long. The larval period lasts from 16 to 18 days, during which time the larva undergoes 5 to 6 moltings.

Pupa.—The general color is shining mahogany brown, and comparatively smooth. Pupation takes place in the ground at about ½ to 1 inch from the surface of the soil. The pupal period is about 9 to 10 days.

Adult (plate 4, fig. 5).—The moth is about 17.7 millimeters long. The forewings are yellowish-brown, with a series of black marginal spots. The hindwings are greyish-yellow, the outer margin being darker. The wing expanse is about 40 millimeters.

According to records obtained at the Entomology Laboratory of the Bureau of Plant Industry, the life cycle from the laying of the eggs to the emergence of the adults varies from 28 to 41 days.

SPOTTED CUTWORM (*AGROTIS* SP.)

DESCRIPTION AND LIFE HISTORY

The eggs.—The eggs are laid singly in rows or in compact layers on either side of the leaf, and when newly laid are transparent. They are nearly hemispherical and strongly ribbed. The incubation period lasts about 6 days.

Larva.—The larvae when newly hatched are nearly white and hairy. They are usually inconspicuous gray or brown, sometimes white, with strong green or olive brown tints. When full grown they are about 3.5 centimeters long. They undergo 4 to 5 moltings within about 18 days of their larval life.

Pupa.—The pupa is light or dark-brown. The anal segment is provided with two curved spines, and other terminal append-

ages like other noctuid pupae. Pupation takes place in the ground, lasting about 5 to 6 days.

Adult (plate 4, fig. 7).—The moth is about 15 millimeters long. The forewings are brown with numerous wavy lines. The characteristic triangular pale spot combined with two triangular black spots is present. The wing expanse is about 44 millimeters.

Control measures for cutworms and armyworms.—1. The fields should be visited often, every day if possible, and when signs of infestations are noted, control measures should at once be applied in order to prevent widespread infestation.

2. Egg masses should be collected and later crushed, or crushed on the leaves.

3. The host plants may be dusted with calcium or lead arsenate mixed with suitable carriers, such as "gaogao" or other fine starch, as suggested for the corn borer.

4. Whenever caterpillars of these pests are noticed in great numbers on nearby wild grasses and other weeds, they should be promptly killed by dusting these intermediate hosts with calcium or lead arsenate in order to prevent future heavy infestations on corn and other cultivated plants.

5. Uninfested fields could be protected by digging steep trenches around, the steep side being towards the fields to be protected.

6. Poison baits consisting of bran, white arsenic or Paris green and molasses are commonly employed in other countries against cutworms and armyworms. These may be tried under local conditions. The bait should be scattered in the evening on the ground especially between the advancing cutworms and armyworms and the field of corn to be protected. The use of sugar-sodium arsenite-water bait, as given for the corn earworm is also suggested.

7. Collecting the caterpillars will help reduce the damage especially if conducted by communities.

8. *Natural enemies.*—Cutworms and armyworms are subject to attack of insect parasites, particularly Tachina flies, certain hymenopterous insects of the genera *Euplectrus* and *Chelonus* being the most important. Small wasp parasites (chalcids) also attack the eggs.

Birds, like the "martinez" (*Aetheopsar cristatellus*) also feed voraciously on armyworms and cutworms. Everybody should coöperate with the government in the protection and encouragement of this and other insectivorous birds.

THE "TOY BEETLE" (*LEUCOPHOLIS IRRORATA* CHEVR.)

Injury.—The larvae or grubs of this insect are known to feed on the roots of various plants, such as rice, corn and sugarcane. They have also been found to attack mango seedlings, pineapple, cannas, etc. The adults or beetles feed on the leaves of mango, "santol", "ciruela", banana, bamboo, sugarcane, etc., but the mango appears to be their most preferred host.

DESCRIPTION AND LIFE HISTORY

The eggs.—The eggs are pearly white, elongate, about 2.5 millimeters in diameter. They are deposited in the soil. As they approach hatching, they become swollen and almost spherical. The incubation period is about 16 days.

Larva (plate 5, fig. 1).—The larvae are fleshy, wrinkled and normally curved. When newly hatched, they are white, but soon become light brown. The full-grown larva is pale yellow and the head, legs and spiracular plates are brownish yellow. The abdominal or hind portion appears blackish due to the intestinal contents visible through the semitransparent skin. The entire back is covered with stout, brownish and thickly set setae, but those on the ventral surface along the sides of the body are longer, but weaker and quite sparse.

Pupa (plate 5, fig. 2).—The pupae, measuring about 3 centimeters long, 1.6 centimeters wide and 1.2 centimeters thick, are brownish yellow, shiny, especially the thorax, wing pads, and the legs. The segments and the spiracles are very distinct.

The life cycle of the toy beetle is about a year in places like Manila and neighboring provinces and in Central Luzon. The beetles begin to emerge during April or May, after the first heavy rains. Emergence may even occur during March. In Occidental Negros there are apparently two broods—the November– December and the April– June broods.

Adult (plate 5, fig. 3).—The adults are glossy and blackish with a reddish tinge. The body, legs and elytra are closely pitted. The sexes are very similar in appearance, but the male is usually smaller than the female. The sexes can be more accurately distinguished, however, by means of the tibial spurs—those of the males being more slender and sharp pointed while those of the females are broader towards the end (spatulate).

Control measures.—1. Collecting the grubs while the land is being prepared. During the plowing of the land, many of them are exposed by the plow. They should be collected and killed.

2. Chickens are very fond of the grubs, so they should be permitted to roam all over the fields during cultivation or plowing. Birds, like crows, are also fond of the grubs. They should be allowed to follow the plow.

3. Adults feed on the leaves of various trees, especially mangoes. By shaking these trees the beetles are dislodged and fall to the ground. They should be collected and killed. Collecting the beetles should be done by communities to obtain the best results. This should be started early as soon as the beetles are on the wing during the months of April to June, so as to prevent as much as possible the laying of eggs. If the collection is done late, many beetles will have laid most or all of their eggs.

4. Digging around dying or wilting plants and collecting the grubs, so as to protect uninfested plants.

5. Encouraging the propagation of wasp parasites, one of them being *Campsomeris aurecollis*. This may be done by allowing nectar-bearing shrubs or bushes, like "sentimiento" (*Stachytarpeta jamaicensis*) to grow around the borders of fields and along fences for the wasps to feed on.

There are other species of grubs that commonly feed on the roots of plants of the grass family, including corn, sugarcane and rice. These may also be controlled by the application of the afore-mentioned control measures suggested for the toy beetle.

THE CORN LEAF HOPPER (*PEREGRINUS MAIDIS* ASHM.)

Leaf hoppers often attack corn. They seem to prefer young and succulent plants, as very little injury to corn plants with tassels has been noted.

Injury.—The punctures made by this sucking insect appear as small white spots with tiny drops of juices around them. Injury first appears on the upper surface of the midrib near its junction with the stalk. Infestations oftentimes spread to the unfolding buds, and to the partially open shucks of the stalks.

Besides the direct injuries caused by the corn leaf hoppers, there is the possibility of their serving as carriers or vectors of maize diseases or that, through the injuries caused, they facilitate the infection by such diseases.

DESCRIPTION AND LIFE HISTORY

The eggs (plate 7, figs. 1, 2, 3).—The eggs are small, white, and flask-shaped. They are laid, several together, in longitudinal slits on the upper surface of the leaves, usually near the

stalks. They may also be laid on the inner surface of partially open shucks on the stalks, but very rarely are laid in the tender stalk.

Nymph (plate 7, fig. 4).—Newly hatched nymphs travel down the leaf to the stalks, and according to Thomas (1913) they develop in the moisture at the base of the leaf. The nymphs are generally yellowish, somewhat mottled black. The eyes are dark red and the antennae bear short arista. When they are disturbed, they move with a quick sidewise motion. There are five (5) moltings during the 16 days of nymphal period.

Adult (plate 7, fig. 5).—The adult hopper is about 9.375 millimeters long, greyish-green with large semitransparent membranous wings, with black markings at the tip. The forewings are yellowish.

Another species of related insect, *Proutista moesta,* which is a fulgorid (Family Derbidae) is quite common on corn and sugarcane, but the damage is not usually serious as to require control. The insect is suspected as a possible carrier of corn and sugarcane diseases.

DESCRIPTION AND LIFE HISTORY

The eggs (plate 6, fig. 2).—The eggs are oval, brownish-yellow, and are reticulated. They measure about .013 millimeter long, and .009 millimeter wide. The incubation period varies from 9 to 11 days.

Nymph (plate 6, fig. 3).—A newly hatched nymph is generally light brown with deep red eyes, located on the dorso-lateral side of the head. The head is blunt on the tip while the abdomen tapers posteriorly. One-day old nymph is about .046 millimeter long and .0205 millimeter at its greatest width.

Adult (plate 6, fig. 1).—The adult is very striking and peculiar, because of the vertical position of the wings when the insect is at rest. The forewing is blue-black with light spots, while the hindwing is dark. Up to this time very little is known of the breeding habits of this insect. Dammerman claimed that Muir had found the nymphs living on decaying wood.

Control.—Whenever the injury is sufficiently serious to demand application of control measures, spraying with soap solution alone or with derris or nicotine sulphate is suggested.

THE CORN LEAF APHIS (*APHIS MAIDIS* FITCH)

The corn leaf aphis is a moderate sized aphid, deep green, with a conspicuous black spot at the base of each of the two protuberances (or cornicles) at the end of the abdomen.

Injury.—The insects cluster on the young and tender leaves of the corn plants, where they suck the sap of the plants. The injury may be followed by fungus attack. Seriously damaged plants droop and may wither and die.

DESCRIPTION AND LIFE HISTORY

Like other aphids or plant lice in the tropics, the corn aphid is known to reproduce parthenogenetically, that is, the females produce young without the previous intervention of the males. This process of reproduction is known as agamic reproduction. There are two kinds of viviparous or parthenogenetic females, the winged and the wingless, the former being responsible for the spread or establishment of new colonies in other parts of the host plants or in altogether new host plants. The alate or winged female is a blackish, delicate insect, with pale-greenish abdomen, and usually measures about 1.7 millimeters long. The apterous or wingless female has blue-green body, with black head, antennae and legs. It is slightly larger than the winged form, being about 2.3 millimeters long.

Control measures suggested.—The insects are not usually abundant as to cause widespread damage. This is partly because of their natural enemies, such as ladybird beetles and larvae of syrphid flies. However, should they threaten to become habitually numerous and destructive in any locality, attempts should be made to kill them when the infestation is as yet localized. This can be done by spraying the infested plants with soap solution with derris or nicotine sulphate.

THE CORN THRIPS (*FRANKLINIELLA WILLIAMSI* Hood)

A species of thrips (*Frankliniella williamsi* Hood) has been found infesting corn. Although thrips may be considered minor pests of corn in most places, serious destructions have been reported from Ilocos Sur and Batangas. Thrips, however, appear to be chiefly serious on corn that is planted late so that it suffers from dryness when the dry season sets in.

Control measures.—Should the degree of infestation be such that control measures are necessary, spraying with soap solution and nicotine sulphate or derris powder is suggested.

THE CORN LEAF MINER (*AGROMYZA* SP.)

A minor pest of corn is a small fly, the larvae of which have been observed to mine the leaves. It being a very minor pest, no control measure is suggested here. The larvae are mostly

parasitized, which probably accounts for the insect being a minor pest.

OTHER PESTS OF CORN IN THE FIELD

Among the most common pests of corn in the field aside from insects are rats, wild pigs, monkeys, parrots, and crows. These are injurious especially to the ears.

RATS

More or less serious destructions by rats have been, and are, commonly reported from many places in the Philippines. They attack not only corn, but also sugarcane, young coconuts, root crops and others.

Several kinds or species of rats are found in the Philippines. One of these is the cosmopolitan brown rat (*Mus norvegicus* Erxl.). Another is the field rat, *Rattus mindanensis* Mearns, which appears to be identical, according to Dammerman, with one of the Malay rats, more likely *Mus rattus jalorensis* Bohn., which is found all over the Malay region and the Indo-Australian archipelago. In general appearance, these rats have long tails, skull characters resembling closely the house rats, but the lower parts are light greyish. The size averages from 17 to 21 centimeters long. This species can thrive in irrigated or nonirrigated fields and also in the forests.

1. Two kinds of poison baits—the formulas of which are given below—have been found effective by Mr. Pablo Soriano, of the Entomology Section, Plant Pest and Disease Control Division, for controlling rats:

(*a*) Strychnine poison bait.

Clean rice	1 ganta
Strychnine powder	8 grams
Sugar	1/8 cup
Salt	9 grams
Soda	8 grams
Starch	1/2 standard cup

All the ingredients except rice are mixed dry, after which two small cupfuls of water are added. Heat is then slowly applied until the mixture becomes a thin paste. This thickens as the heat continues. The rice is finally added, and the mixture stirred until all the grains are well coated. The mixture is dried under the sun and is applied in the infested fields, in small heaps at distances depending upon the degree of infestation. Banana leaves may be used for placing the bait on.

(*b*) White arsenic poison bait.

Clean rice	2.5 gantas (uncooked)
Fish	1/2 kilo

Sugar	2 cups
White arsenic	1 salmon canful
Anis oil	1 teaspoonful

The rice, fish and sugar are cooked together with enough water, over a slow fire. These should be thoroughly mixed and when nearly cooked, the white arsenic is added, and the mixture very well stirred. The anis oil is finally added. The mixture is to be applied in the fields in small lumps like the strychnine poison bait.

A simple bait which is commonly employed in the field is a mixture of cooked rice and white arsenic. This consists of about one salmon canful of rice and three or four spoonfuls (levelful) of white arsenic. To make the bait attractive cooked fish with some broth should be added.

An attractive bait is roasted shredded coconut meat. Ripe bananas may also be used. Besides white arsenic, barium carbonate and red squill preparations may also be used as poisons against rats.

2. The use of calcium cyanide or cyanogas as a fumigant. The cyanide, preferably in powder form, is introduced into the holes or burrows, which are plugged with mud after the application in order to prevent the escape of gas. Suitable pumps or blowers can be purchased from local hardware stores. Carbon bisulphide may also be used as a fumigant.

3. The value of clean culture cannot be overestimated. Piles of brush, logs, etc., should not be left in the fields, dikes and road sides, as these afford hiding and breeding places for rats. Likewise weeds and shrubs should not be allowed to grow thickly on river banks and aqueducts. All white ant mounds in rice fields or in plantations should be destroyed so as to eliminate suitable hiding and breeding places for rats.

4. The use of traps will help, to a certain extent, in minimizing rat injury.

5. Attempts should also be made to protect, and encourage the propagation of, the natural enemies of rats, such as owls, cats, etc.

WILD PIGS

Wild pigs are especially abundant and destructive near mountains and forests. Destruction to corn crops by pigs consists in the breaking of the stalks in order to get at the cobs.

Control measures.—1. The use of white arsenic for poisoning wild pigs has been suggested. Fruits or tubers such as banana, sweet potato or cassava could be used. White arsenic powder

is placed in holes bored into the food material. The holes are then closed with the pieces bored out. These poison baits should be placed in areas where the wild pigs generally enter the plantations or the places frequented by them.

2. Phosphorous compounds have also been employed against wild pigs. In Mindanao a phosphorous paste compound in cans has been reported to have given good results. This may be purchased from Zamboanga, Zamboanga, upon inquiry from the Provincial Agricultural Office of the Bureau of Plant Industry there.

3. Fences for plantations intended as a protection against wild pigs should be substantially strong. Wire fences are especially good and perhaps cheaper in the long run than wooden or bamboo fences.

4. Trapping will help toward minimizing the injury by the pigs. Various devices for trapping wild pigs are known in different localities in the Philippines.

5. Hunting wild pigs with dogs and the liberal use of shotguns will also help much toward lessening the ravages of the pigs.

MONKEYS

Monkeys are at times observed attacking corn ears. They also attack fruits, peanuts, etc.

Control.—1. Liberal use of shotguns is an effective way of lessening the ravages of monkeys.

2. Good hunting dogs will also help, at least, in scaring the monkeys away from the corn field.

3. Trapping the animals. A trap for monkeys, which is said to have given good results in some places, is as follows:

> A rectangular cage or enclosure of wood or bamboo slats is built on the ground, at a place frequented by the monkeys or near the place where they usually stay. Such a cage or enclosure may be 2 to 2½ meters high, 2 meters long and 1½ meters wide. It may be made longer and wider, if desired. If it is to be a portable trap, it need not be made very big as to make transfer difficult. Through the center of the top of the cage is fitted securely a cylindrical galvanized iron entrance, half in and half out. This may be made about half a meter long and with a diameter big enough to allow the biggest monkey to get in. For bait, ripe banana fruits, corn ears or any other attractive food may be used. With an entrance as described, a monkey can easily get in, but finds it impossible to get out once in, as it cannot get hold of the upper rim of the galvanized iron entrance. In its desperation, the incarcerated monkey makes loud cries, which attract its fellows. A trap of this type can catch several or many monkeys at a time.

PARROTS

In some places in the Philippines, parrots, more especially the white ones or "parakeets" attack corn ears. When they occur in flocks they may cause considerable damage.

Control.—1. Shooting the birds with shotguns and trapping them are among the methods employed in minimizing damage by these birds.

2. Various methods of scaring away the birds, such as the use of scarecrows, noise-making devices, etc., are also employed.

CROWS

Crows are not entirely harmful. They are both carnivorous and vegetarian. Among their foods are insects, such as root grubs, beetles, locusts, etc. However, they are observed, now and then, to cause more or less appreciable trouble to corn and other crops and to poultry. Injury to corn crops consists in the tearing off of the husks of the corn ears and the eating up of the kernels. Since crows are partly insect feeders, they should not be entirely condemned. It is only when they are definitely known to be causing injuries to crops and poultry that steps may be taken to lessen their ravages.

Control.—The following control measures may be employed:

1. Shooting the birds with shotguns.

2. Scarecrows are often effective in preventing crows from infesting a corn field. Besides the use of ordinary scarecrows, hanging dead crows in the field is often done. Other contraptions such as windwheels and noise-making devices are also employed.

3. The use of poisons, like white arsenic is practical. This may be mixed with rice, fish or meat or other attractive bait.

INSECTS THAT ATTACK STORED CORN

THE RICE WEEVIL
(*Calandra oryzae* L.)

The rice weevil is a cosmopolitan insect and is considered one of the worst pests of stored grains. In the Philippines it is considered one of the two worst pests of corn. It is particularly abundant in warm countries, where it breeds continuously and destroys all unprotected grain. In the United States, this attacks rice, wheat, oats, corn, barley, sorghum, buckwheat, kafir, macaroni and other hard products, while in the Philippines destruction has been noted mostly on corn and rice.

Injury.—Injury is not only confined to stored corn, but also to maturing ears with poorly developed and damaged husks. Both the larva and the adult damage the kernel. The adults puncture the kernels with their beaks and these holes are used for oviposition. The young larvae tunnel the grains or kernels, and eat all their contents. After consuming the contents, the larvae move to other grains, and the process is continued until all the grains are infested and destroyed.

DESCRIPTION AND LIFE HISTORY

The eggs.—The tiny eggs are inserted inside the kernels by the powerful ovipositor of the mother insect. The incubation period varies from 3 to 5 days.

Larva (plate 8, fig. 2).—The larva is a short thick-set, legless grub, almost white, with brown head. There are four stages in the entire larval period, which lasts about 21 days. The pupal period lasts about 5 days.

Adult (plate 8, fig. 1).—The adult weevil has a long snout, and is generally dull reddish-brown with four reddish spots on the strongly punctured elytra.

The complete life cycle of the insect is around 35 days.

Control measures recommended.—As control measures the following may be employed:

1. All corn ears and kernels should be thoroughly dried on concrete floor, galvanized iron sheets, sawali or buri mats before storing. This will reduce the moisture content of corn below 10 per cent, which renders it practically safe from weevil attack.

2. On a small scale, all sun dried kernels should be placed inside heated empty kerosene cans, the small opening at the top of the cans soldered later. These can then be stored.

3. Varieties of corn that produce well-developed ears with tight-fitting husks should be planted, but the ears must be dried properly before storing. The natural protection offered by the husks minimizes infestations.

4. Fumigation with carbon bisulphide, using 10 to 20 pounds of the fumigant per 1000 cubic feet of room space or volume, has been found effective. As carbon bisulphide is inflammable every possibility of fire should be avoided. The gas is very poisonous and should not be inhaled.

5. A good fumigant that is not inflammable is a mixture of carbon tetrachloride (one part) and ethylene dichloride (three parts) by volume. Twelve to fourteen pounds of the mixture

are usually used for every 1000 cubic feet of room volume. Chloropicrin may also be used as fumigant, using three pounds per 1,000 cubic feet.

6. Seed corn may be stored with naphthalene to prevent infestation.

7. Ordinary lime has been suggested as a repellant against weevils. This may be mixed with grains or ears.

8. Derris powder may also be used.

THE GREY RICE MOTH OR ANGOUMOIS GRAIN MOTH
(*Sitotroga cerealella* Oliv.)

Although this insect is primarily a pest of stored rice, it may be included here as it is also known to infest seriously corn grains. It also attacks other grains, including wheat. The insect appears to be of world-wide distribution.

The caterpillar (plate 8, fig. 3) is white with a yellowish tinge and attains a length of about one centimeter. It pupates in the grain. The adult moth (plate 8, fig. 4) is about a centimeter long, of a whitish yellow or buff color. The fore or front wings are fringed with hairs at the apical angle. The hindwings are grayish and likewise fringed with hairs along the hind or anal margin.

In the United States, the life cycle has been found to be about five weeks.

OTHER MOTHS

The other moths that may infest corn and corn products are the rice moth (*Corcyra cephalonica*), the fig moth (*Ephestia cautella*), the Indian meal moth (*Plodia interpunctella*) and the Mediterranean flour moth (*Ephestia kuehniella* Zeller).

Control.—The most effective method of controlling the moths, as well as other insects found infesting corn and corn products in storage, is by fumigation with the different substances already given for the corn weevil.

The installation of pipes in "bodegas" or store rooms so these can be steam-heated to a temperature of 120° to 150° Fahrenheit is also effective. Subjection of the grains for three or more hours under these temperatures will kill all insects present, including the eggs. This method is commonly employed in flour mills and grain elevators in the United States and is said to be cheaper in the long run than fumigation.

ACKNOWLEDGMENT

The writers wish to thank Doctor Gonzalo Merino, chief of the Plant Pest and Disease Control Division, for reading and criticizing the manuscript. The identification of the thrips (*Frankliniella williamsi* Hood) by Mr. Dudley Moulton of California is hereby also acknowledged. He says that this species occurs in Eastern United States and this record in the Philippines is very interesting as it shows the distribution of the species far beyond our present knowledge.

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ILLUSTRATIONS

PLATE 1

Phases of the Oriental Migratory Locust:

FIG. 1. A hopper of the solitary phase, enlarged. (Hoppers as well as adults of the solitary phase have a tendency to resemble their surroundings.)

2. An adult of the solitary phase, enlarged. (Note the color and the rather convex pronotum or hood at A.)

3. A hopper of the migratory phase, enlarged. (Note the black and brick red color in contrast to that of the solitary phase; hoppers and adults have uniform color.)

4. An adult of the migratory phase, enlarged. (Note the saddle-shaped prothorax, with a depressed pronotum at A.)

PLATE 2

Stages of the corn borer (*Pyrausta nubilalis*):

FIG. 1. Egg mass of the corn borer on a leaf of corn, indicated by arrow, about natural size.

2. A caterpillar in its tunnel in a portion of a corn stalk, about natural size.

3. A portion of a corn stalk showing pupa, about natural size.

4. A female moth, about natural size.

5. A male moth, about natural size.

PLATE 3

The corn earworm, *Heliothis armigera* (*Heliothis assulta* or *Chloridea obsoleta*).

FIG. 1. A caterpillar of the corn earworm showing its work on an ear of corn, size somewhat reduced.

2. A pupa, size somewhat reduced.

3. An adult, size somewhat reduced.

PLATE 4

Cutworms and armyworms:

FIGS. 1 and 2. An adult and caterpillar, respectively, of the grass army worm (*Spodoptera mauritia*), about twice natural size.

3 and 4. An adult and caterpillar of the common noctuid (*Prodenia litura*), about twice natural size.

5 and 6. An adult and caterpillar of another armyworm (*Cirphis unipuncta*), about twice natural size.

7. An adult of *Agrotis* sp., the caterpillars of which also attack corn, about twice natural size.

PLATE 5

FIGS. 1, 2 and 3. Grubs, pupae, and adults, respectively of the "toy beetle" (*Leucopholis irrorata* Chevr.), about natural size (after Otanes).

PLATE 6

FIGS. 1, 2, and 3. Adult, egg and nymph, respectively, of a sucking insect—a fulgorid (*Proutista moesta*) on corn. Adult 40 times natural size, egg 20, and nymph 40 times.

FIG. 4. An adult beetle of *Monolepta bifasciata*, which attack corn silk. Enlargement about 10 times natural size.

PLATE 7

The corn leaf hopper (*Perigrinus maidis* Ashm.). All figures redrawn from Thomas.

FIG. 1. Portion of corn leaf showing egg punctures.
2. Eggs enlarged in place in the punctures (in situ).
3. Eggs enlarged—before hatching showing eye spots.
4. Newly hatched nymph—much enlarged.
5. Adult female—much enlarged.

PLATE 8

FIGS. 1 and 2. Adult and larva of the grain weevil (*Calandra oryzae*), which seriously infests stored corn; each figure 6 times natural size.

3 and 4. Larva and adult of the rice moth (*Sitotroga cerealella*), which at times also seriously infests corn in storage; each figure 6 times natural size.

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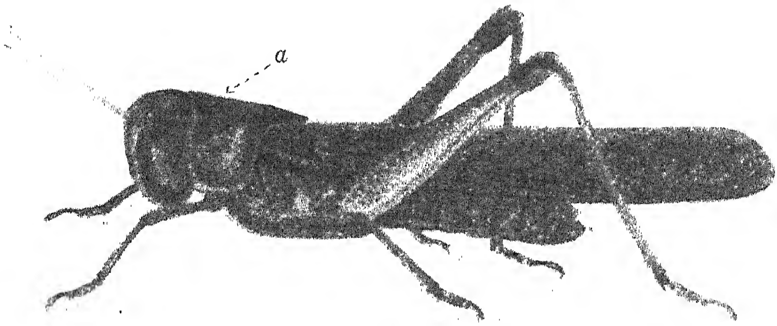

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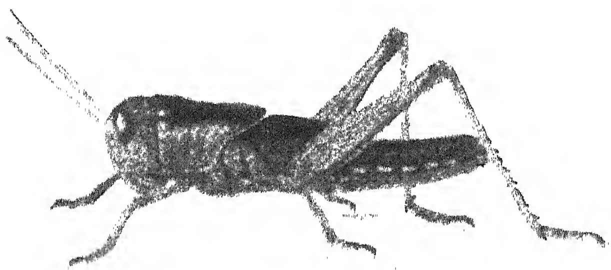

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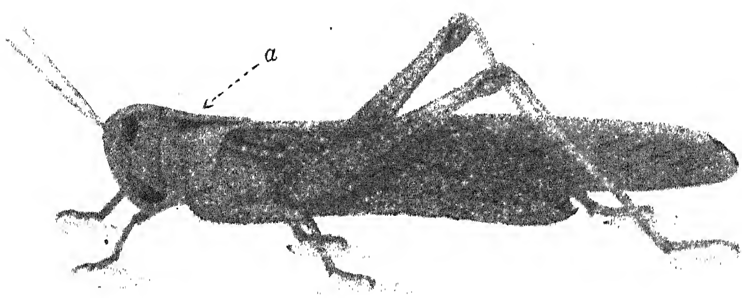

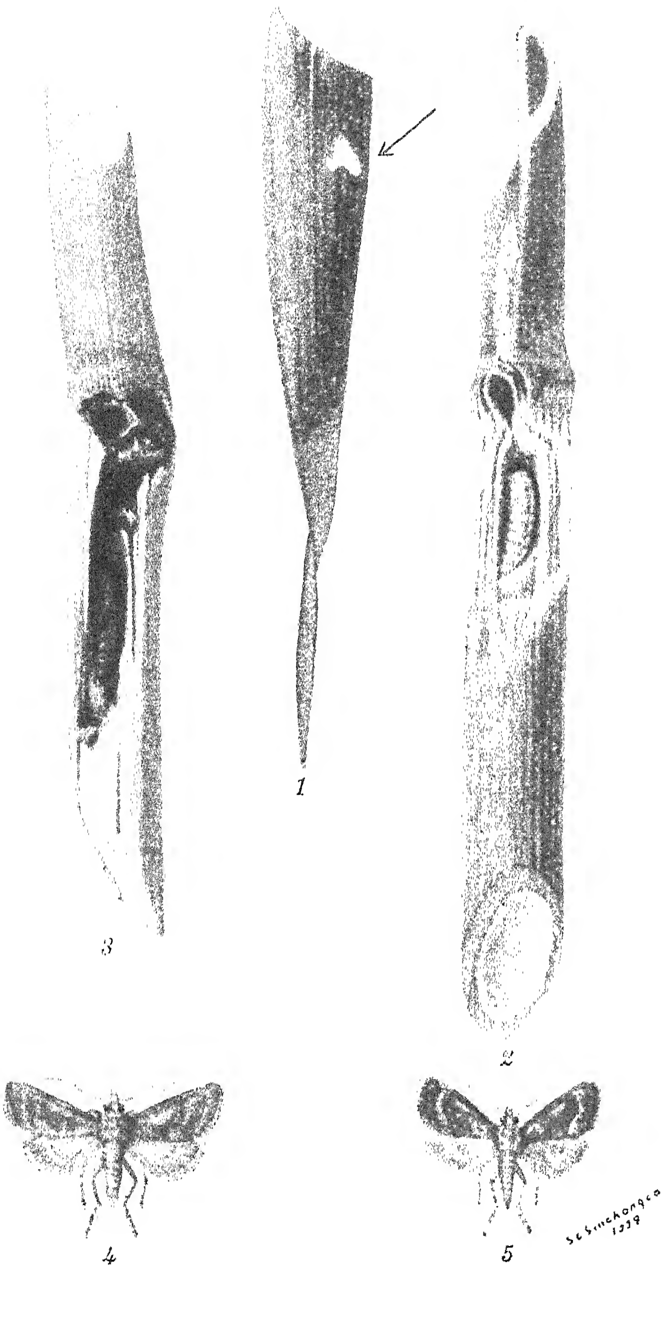

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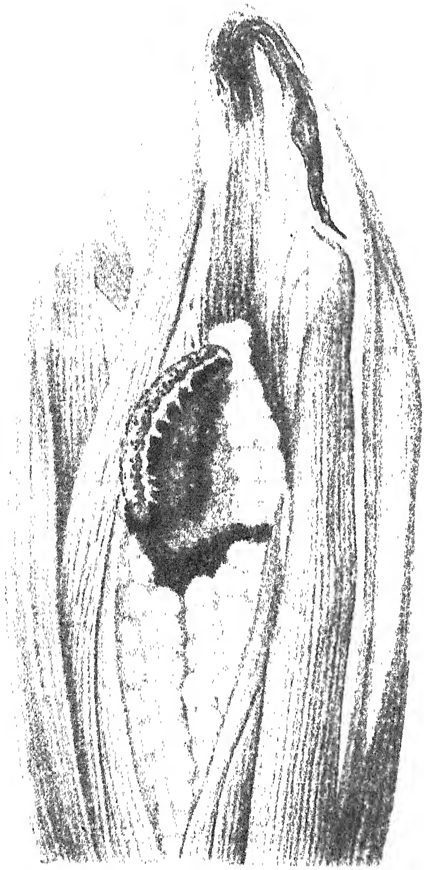

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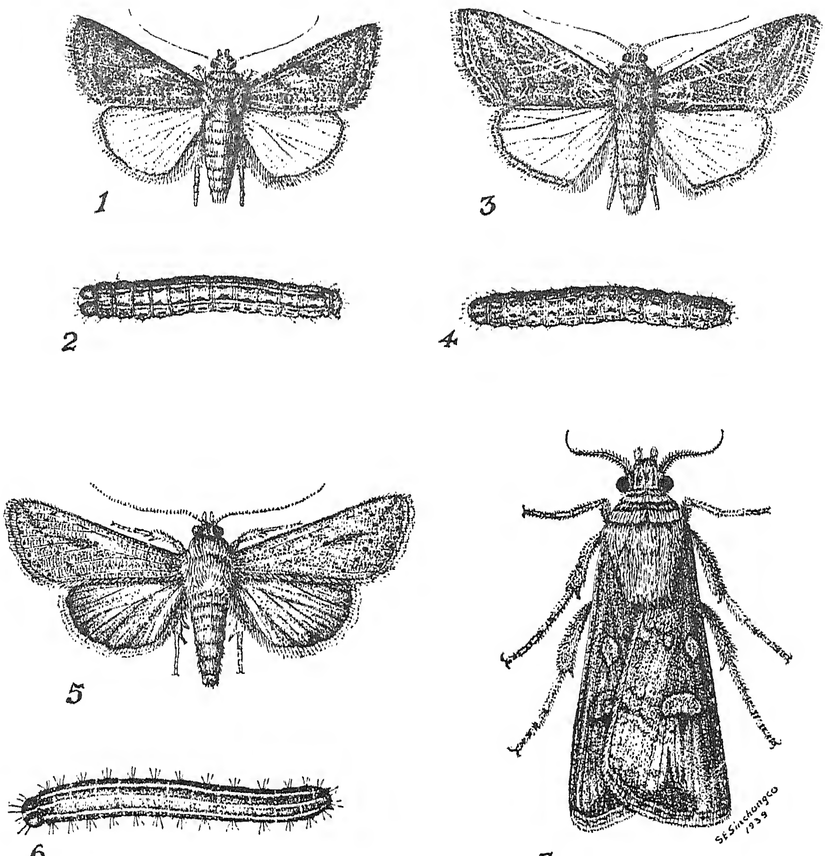

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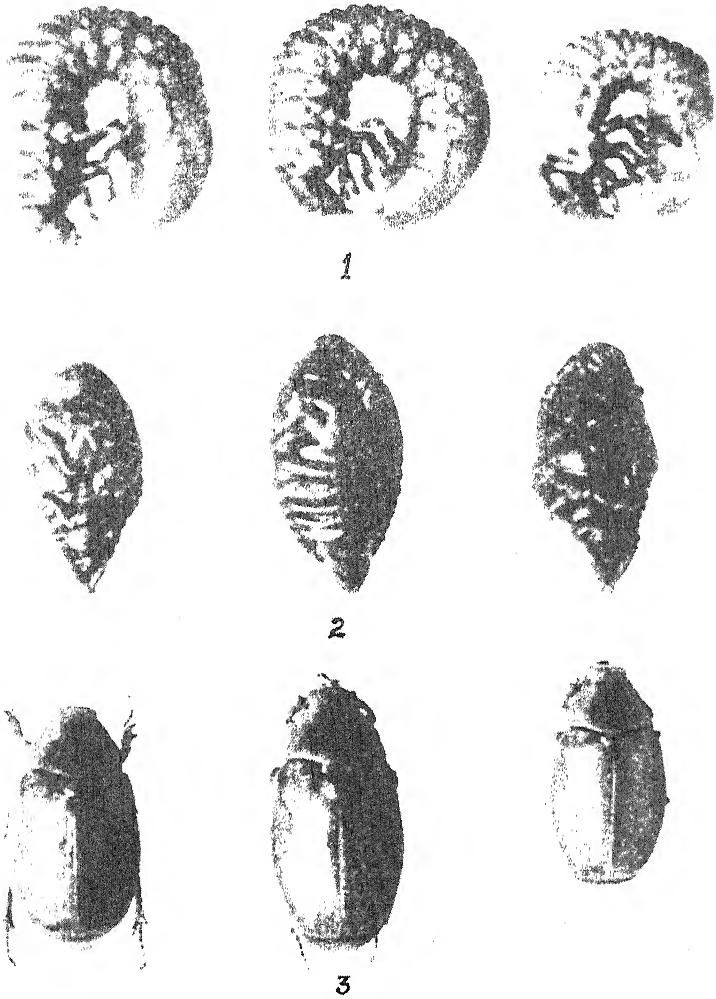

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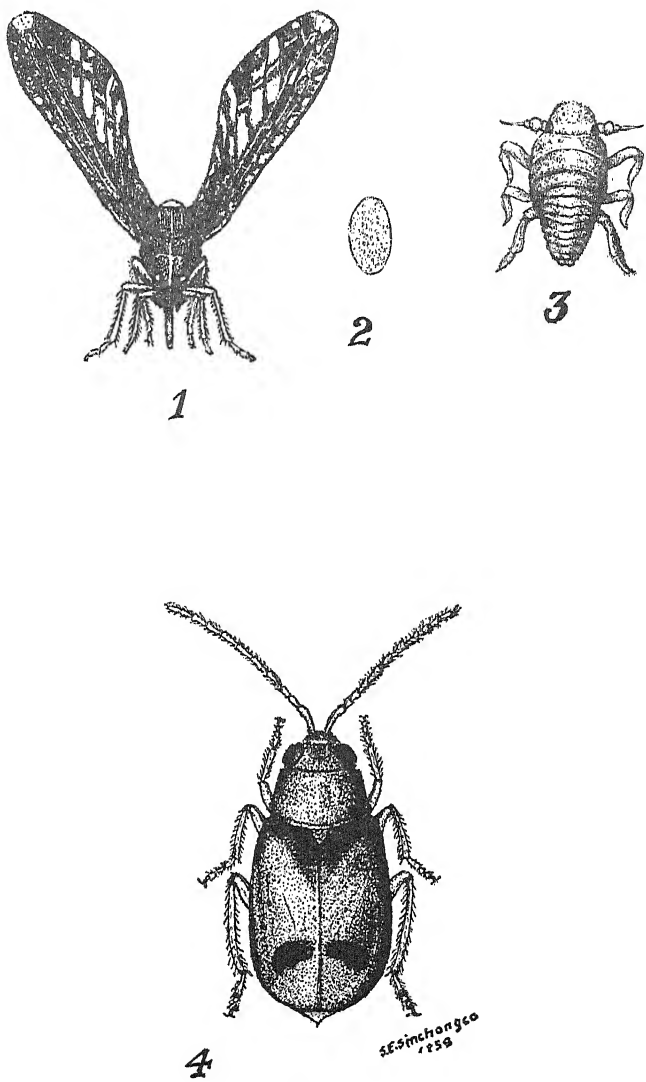

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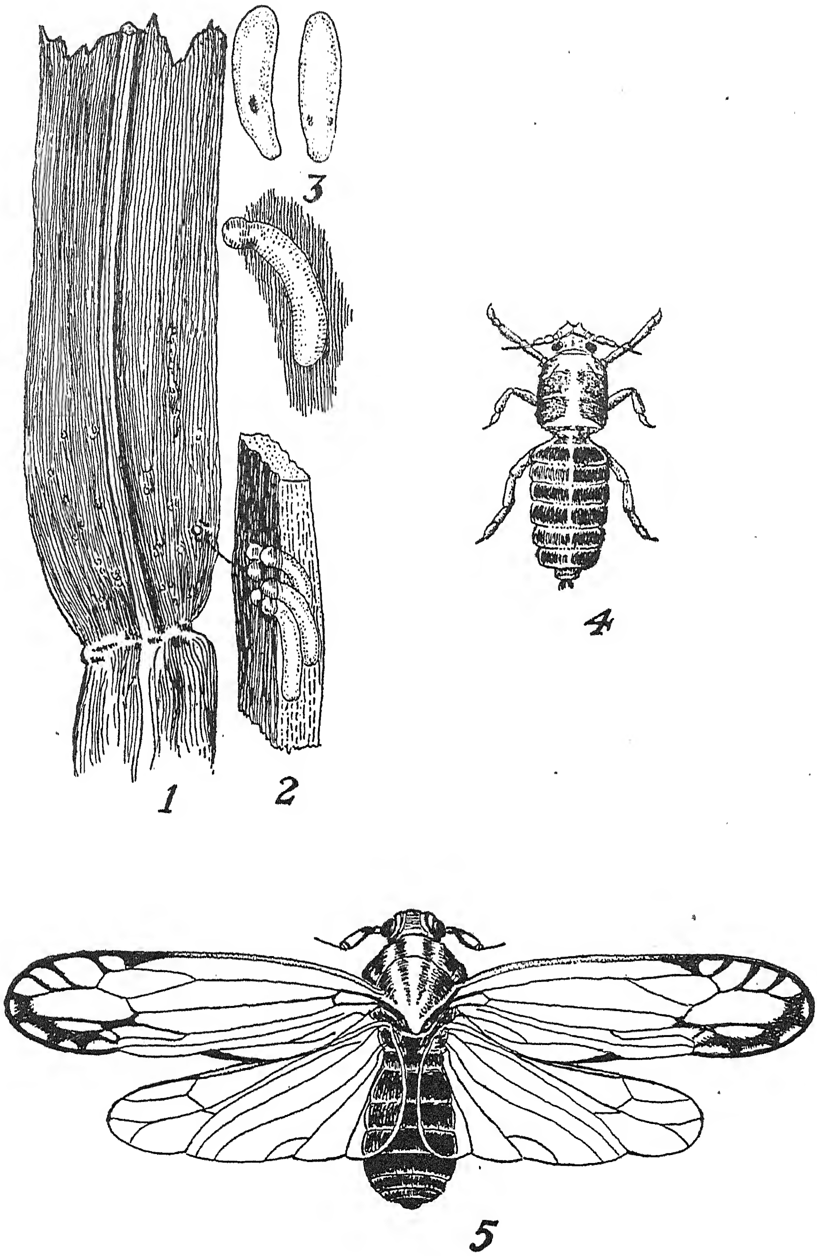

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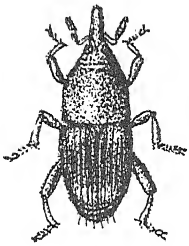

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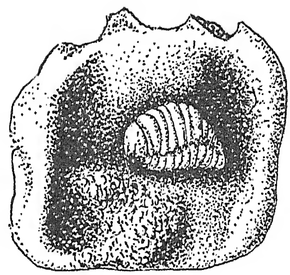

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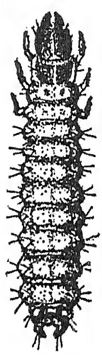

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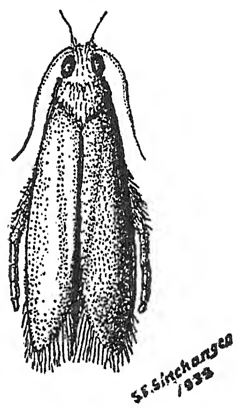

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PLATE 8.

QUARTERLY NOTES

The appointment of Mr. Francisco D. Marquez, former chief, Agricultural Extension Division, Bureau of Plant Industry as Administrative Officer, Department of Agriculture and Commerce comes as a reward to his twenty-four years of loyal service in the Government, practically all of it having been spent first with the defunct Bureau of Agriculture and, until his appointment, with the Bureau of Plant Industry.

He is familiar with many phases of our agricultural industry, being a devoted student and ardent advocate of rural improvement through improved agricultural practices and has traveled extensively throughout the Philippines.

Mr. Marquez is a 1915 graduate of the College of Agriculture, University of the Philippines. Soon after his graduation, he was made graduate assistant in the Department of Agronomy of his Alma Mater, and successively occupied positions of responsibility. Superintendent of La Carlota Experiment Station, Occidental Negros; chief of the Agricultural Extension Division, Bureau of Plant Industry since October 1, 1936 up to the time he was named Administrative Officer of the Department of Agriculture and Commerce on April 8, 1940.

He passed the first assistant agronomist examination given by the Bureau of Civil Service in 1918 (the highest agricultural examination in the government service) and was, for some time, assistant chief executive officer in the leaf-miner campaign in Laguna, Tayabas, and Batangas in 1930.

One of the Technical Consultants of the National Economic Council, member of the Philippine Technical Agriculturists Society, the Philippine Scientific Society, and the National Research Council. Also, a merit badge counsellor of the Philippine Boy Scouts, and member of the Y. M. C. A. Was executive officer of the Philippine Exposition, Department of Agriculture and Commerce participation in 1935; assistant director-general of the Pasig Carnival and Fair, 1936 and 1937.

Born of impecunious but respectable parents in Taal, Batangas, on October 4, 1893. As a student, he was self-supporting through and through, and won promotions through hard work and sheer merit.

CORRECTION

DOORDRUK voor:

DEPARTEMENT
VAN ECONOMISCHE ZAKEN
No. 1026L

Department of Agriculture and Commerce, Division of Publications, Manila.

BATAVIA(C)., *6th March 1940.*

The Director of the Bureau of Plant Industry,
Manila.

Dear Sir,

In the Philippine Journal of Agriculture, Vol. 10, No. 3, 1939, Messrs. J. P. Torres and T. G. Garrido from the Bureau of Plant Industry have published an article, entitled "Progress Report on the Breeding of Abacá (*Musa textilis* Née)", in which it is stated that Messrs. Alunan and H. T. Edwards were not allowed by the Dutch Government to visit the abacá plantations and factories in Sumatra, which caused the writers of this article to conclude, that "obviously the methods of abacá production in Sumatra are being kept secret by the Dutch Government."

In this connection I beg to inform you that the Government of the Netherlands Indies have no wish to withhold any information on this subject and is quite prepared to put the results of scientific research of the Government Research Department on this matter at the disposal of any genuine enquirers.

If Messrs. Alunan and Edwards met with a refusal to be allowed to visit certain abacá plantations and factories on the Eastcoast of Sumatra, this may be due to the fact that these plantations were private property.

As a matter of course private estates are entitled to withhold information concerning the results of their own researchwork, which often is regarded as a trade secret.

Even our own Government Officers do not always get access to information on the researchwork of private estates.

Copy of this letter has been sent to the Department of Agriculture and Commerce, Division of Publications, Manila.

Yours faithfully,

DIRECTOR OF ECONOMIC AFFAIRS,

By order:

Chief of the Agriculture Service,
w. g. (A. LUYTJES)